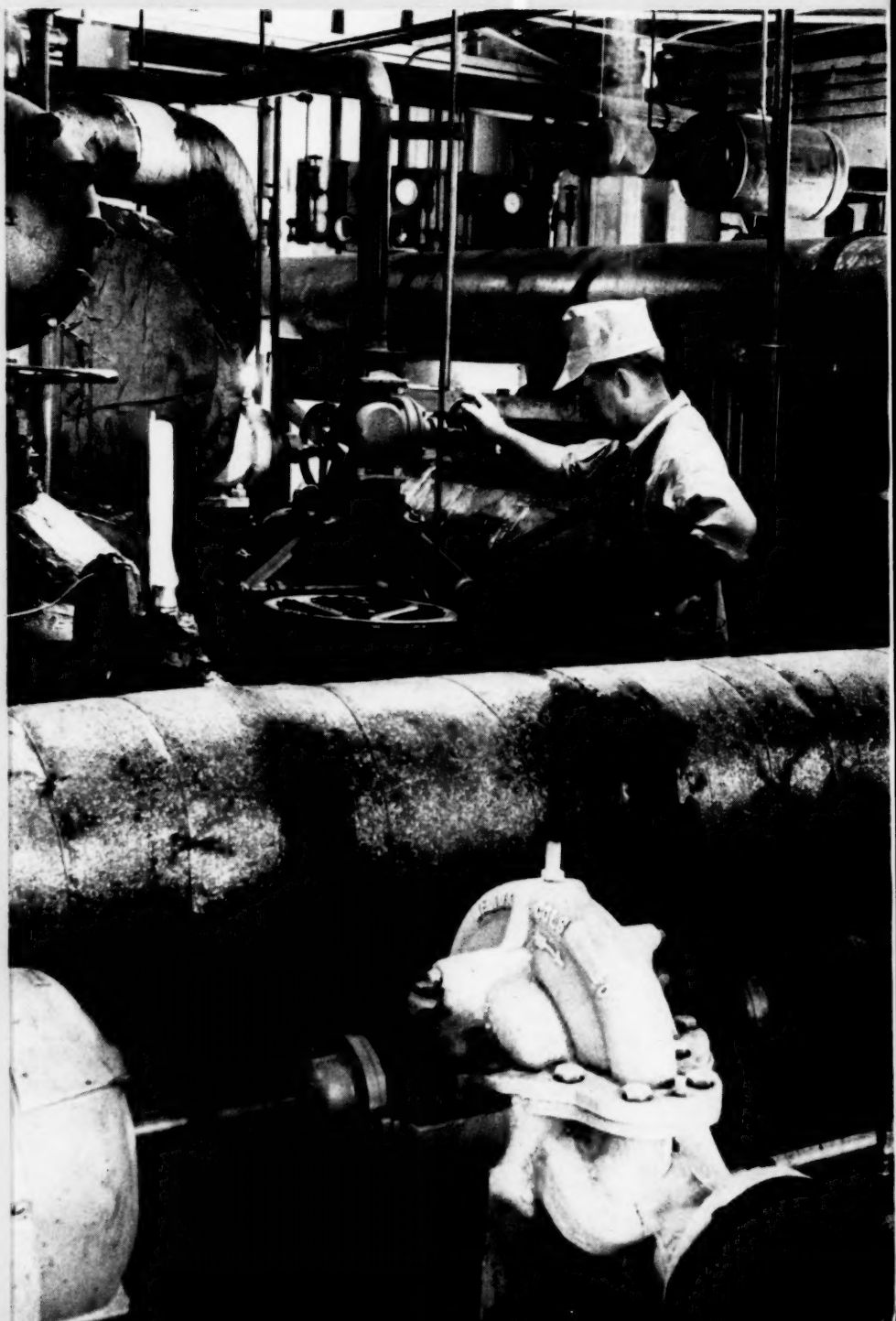
AIR CONDITIONING HEATING AND VENTILATING

NOVEMBER 1959

For the Engineer
Engaged in DESIGN
APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT

One of two 55-ton York reciprocating ammonia brine chillers supplying 17 deg brine to freeze soil at the Newtown Creek Polution Project, New York City. This method permits the sinking of a deep shaft without conventional expensive earth supports. See page 65.



IN THIS ISSUE

Selection of Boiler Blow-Off Valves 53

When and Where to Use Make-Up Air 60

Regulation of Excessive Heat in Industry 67

Reciprocating Refrigeration Compressor Control 76

Protecting Cooling Towers from Freezing 63

Piping for Suction Line Superheaters 56

Detail Sheet—Wiring Diagrams 79

Data Sheet—Quick Price Estimates 81

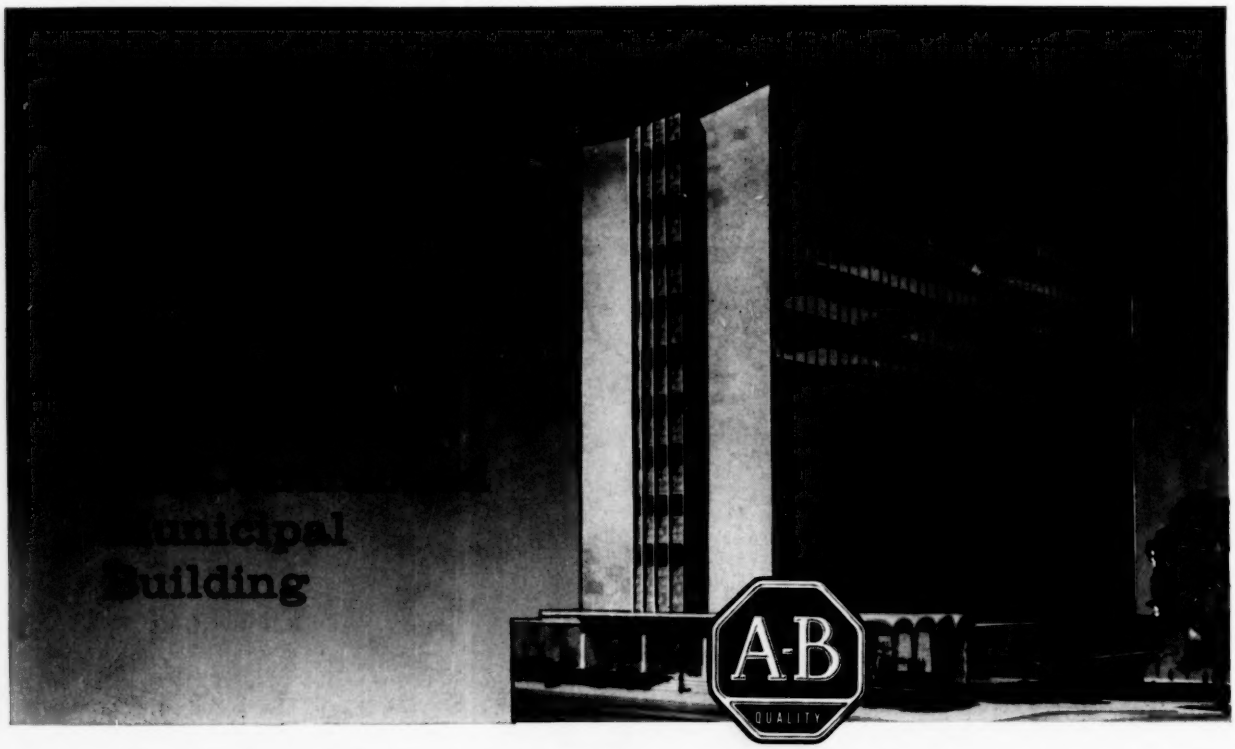
Function and Operation of BRI 83

Industry Must Train Its Engineers 86

New Equipment 96

New Literature 93

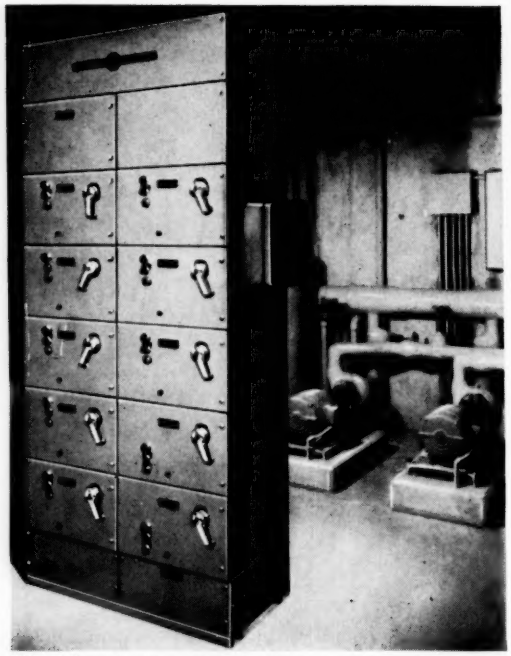
Ad-Digest 143



...controls by **ALLEN-BRADLEY,** *of course*

Allen-Bradley quality motor control is a *natural* in the years-ahead planning that goes into a new building. Its simple ONE moving part solenoid design assures *millions* of trouble free operations. And the double break, silver alloy contacts never need service attention. Build with the future in mind—insist on Allen-Bradley—the motor control of *proven* and *consistent* reliability.

Main Allen-Bradley control panel—consists of Bulletin 798 control center alongside cabinets for compressor motor starters.



This Allen-Bradley Bulletin 798 control center contains the combination starters which are for motors on the auxiliary pumping equipment.

ALLEN-BRADLEY *Quality* Motor Control

Member of NEMA

Allen-Bradley Co., 1330 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

How Armstrong Steam Humidifiers Are Used in Air Conditioning Systems

The design of Armstrong Steam Humidifiers makes them an excellent choice for air conditioning systems.

Since they utilize dry steam, Armstrong Steam Humidifiers do not create the moisture and corrosion problems common with some methods. Dry steam is readily mixed with air. There is no mineral dust. There is no lag in response to the humidity control.

The air modulating model of the Armstrong Steam Humidifier is most commonly used with air conditioning systems. (Electrically operated models are also available.) The air operator, on a signal from a pneumatic hygrostat, opens the modulating valve in proportion to the demand to give accurate humidity control without significant overrun.

For air conditioning systems, Armstrong Steam Humidifiers are installed to discharge steam directly into the plenum chamber or into ducts. Common methods of installation are shown in the accompanying drawings and photograph.

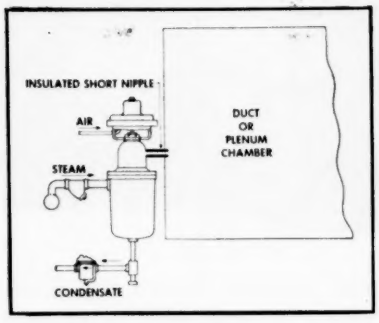


Fig. 1—Armstrong Humidifier discharging to duct or plenum through insulated nipple which should be as short as possible.

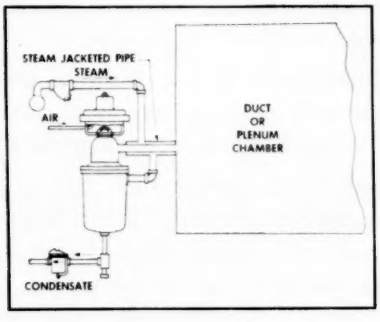


Fig. 2—Armstrong Humidifier discharging through short length of steam-jacketed pipe. Note steam supply to humidifier should enter top of jacket and leave at the bottom.

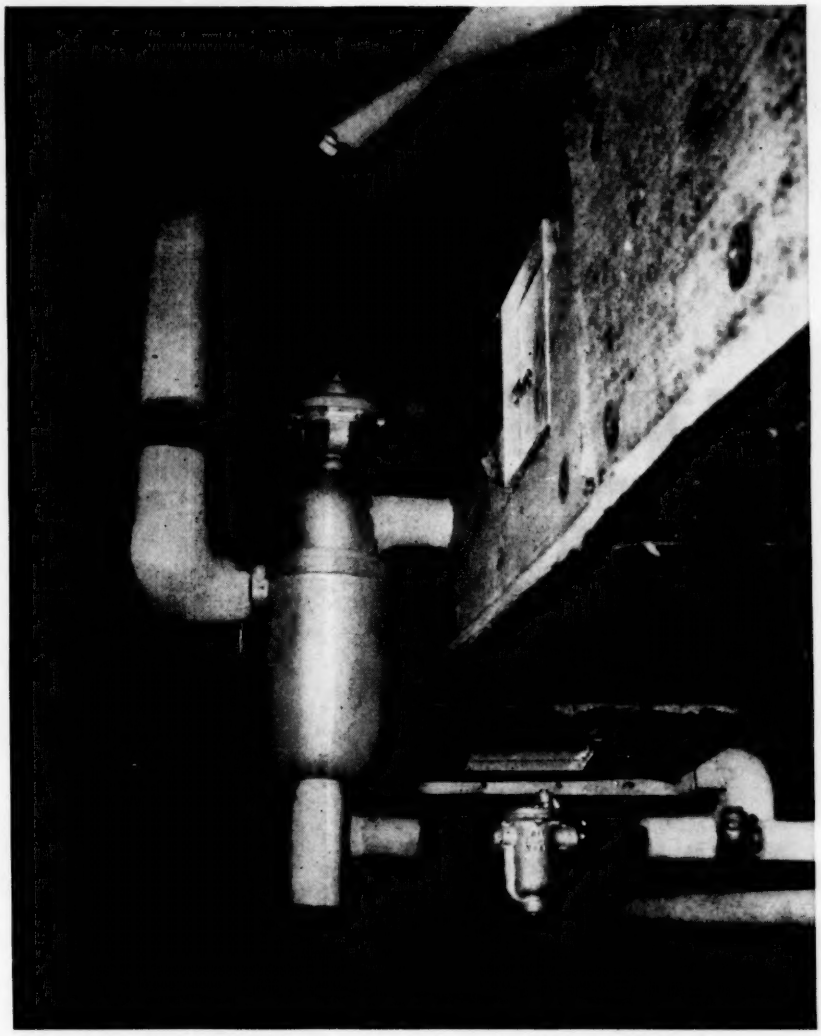


Fig. 3—Installation of an air modulating Armstrong Humidifier in the air conditioning system of a hospital.

The total installed cost of Armstrong Steam Humidifiers in air conditioning systems is surprisingly low. This results from the simplicity of the installation plus the fact the Armstrong price includes the integral air operator, strainer and steam trap, items that are customarily extra. The units are available with or without hygrostat.

When you have an air conditioning job, you can specify Armstrong Steam Humidification in confidence. Guaranteed tabulated capacities are available for all models and all steam pressures. The units themselves are guaranteed in writing to satisfy or purchase price will be refunded. Every installation is backed by a sales and service network that blankets the United States and Canada.

For Complete Information

Bulletin 500—16 pages. General data including specifications and capacities of both air and electrically operated models.

Bulletin 600—4 pages. Hospital humidification. Contains helpful tables for all air conditioning jobs.

Bulletin 505—8 pages. Woodworking plant humidification.

Bulletin 506—8 pages. Paper fabricating plant humidification.

To get your copy, just call your local Armstrong Representative or write directly.

ARMSTRONG MACHINE WORKS
8465 Maple Street
Three Rivers, Michigan

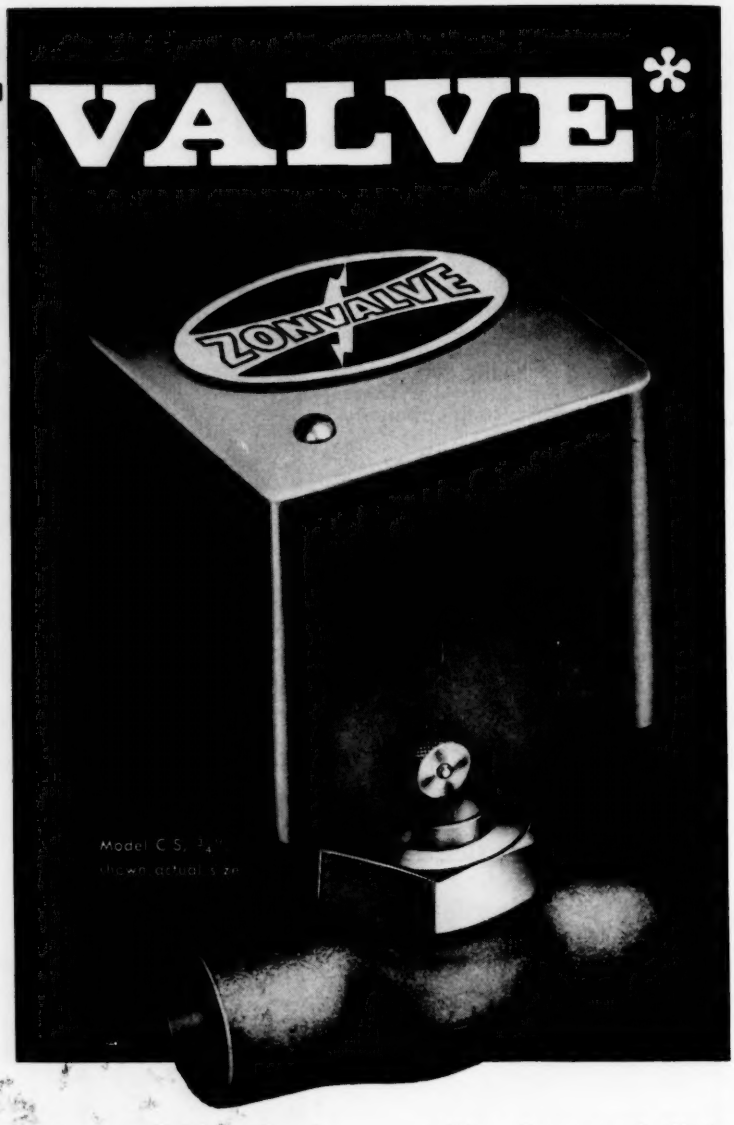
"See our catalog in Sweet's Industrial Construction File"

ZONVALVE*

the zone control valve with

100% SHUT OFF

for positive temperature control!



Globe-type construction of Zonvalve guarantees complete shut-off on steam, hot and chilled water systems. This means positive temperature control, without heat waste.

Engineer-architects and heating men recognize the superiority of Zonvalve's design features. Self-aligning plug insures positive closure and eliminates jamming. Valve is powered by a heavy-duty motor, with pinion, gear and cam assembly—for extra-long life and silent, dependable operation. Zonvalve's "hand-size" compactness makes installation possible where space is limited. Zonvalve is the *only* valve that uses Teflon for a self-lubricating, permanent seal.

Zonvalve is competitively priced. Built to last a lifetime, *it is the only zone control valve with an unconditional written Five-Year Guarantee!*

Zonvalve is ideal for modernization and new construction, in residential, commercial and industrial zone heating. For the finest in zone control equipment—specify Zonvalve, install Zonvalve!

New color brochure contains layouts, applications, customer benfits, technical data and prices. Write for Brochure D-11.

ZONVALVE

* This Trade-Mark is registered by Heat Timer Corp., manufacturers of heating controls and motorized valves since 1935. It is your guarantee for positive zone control.

ZONVALVE MODELS

RS-A C-S S-S

AVAILABLE IN SIZES FROM TO

HEAT-TIMER CORP.
657 BROADWAY, NEW YORK 12, N.Y.

AIR CONDITIONING HEATING AND VENTILATING

Volume 56, Number 11 **November, 1959**

EDITORIAL STAFF

EDITOR
Clifford Strock

ASSOCIATE EDITORS
Nathan N. Wolpert
William B. Foxhall
Harold M. Englund
Richard L. Koral

ADVERTISING REPRESENTATIVES

NEW YORK
Harry J. Twine
R. E. McLoughlin
93 Worth Street
CAnal 6-8120

CLEVELAND
Edward B. McEntee
17115 Hillsboro Rd.
IVanhoe 1-6857

CHICAGO
George G. Turner
Peter B. Impasto
228 N. LaSalle St.
FInancial 6-6864

BIRMINGHAM
Fred W. Smith
1201 Forest View Lane
TRemont 1-5762

DALLAS
Richard B. Hoierman
9006 Capri Drive
DAvis 7-3630

LOS ANGELES
Whaley Simpson Co.
6608 Selma Ave.

SAN FRANCISCO
Whaley Simpson Co.
700 Montgomery Bldg.

EXECUTIVE OFFICERS

PRESIDENT
Robert B. Luchars

VICE PRESIDENT-TREASURER
Edgar A. Becker

SECRETARY-PUBLISHING MGR.
Harold L. Gray

AIR CONDITIONING, HEATING AND VENTILATING is published monthly by The Industrial Press, 93 Worth Street, New York 13, N. Y. Executive, editorial and subscription offices, 93 Worth Street, New York 13, N. Y. • Entered as second-class matter August 31, 1956 at the Post Office, East Stroudsburg, Pa., under Act of March 3, 1879. • Subscription rates: In the United States and Canada, one year, $3; two years, $5; three years, $6; in Mexico, Central America and South America, one year, $4; two years, $7; three years, $8; in all other countries, one year, $7; two years, $12; three years, $14. Single copies, 50c. • Copyright 1959, by The Industrial Press. Permission required to reproduce articles. • Contents of AIR CONDITIONING, HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and microfilmed by University Microfilms, Ann Arbor, Mich. • Member: National Business Publications, Business Publications Audit of Circulation, Inc., Society of Business Magazine Editors.

PIPING
Boiler Blow-Off Valves 53
A guide to their selection and specification ..... E. E. Finsel

REFRIGERATION
Suction Line Superheaters 56
Piping arrangements for best results ..... J. R. Harnish

AIR HANDLING
Air Sensible Heat Change Factors 59
Factors speed heat gain calculations ..... G. Neal

VENTILATION
When and Where Is Makeup Air Necessary? 60
How to measure need and amount of supply air ..... G. M. Hama

AIR CONDITIONING
Two Methods that Will Protect Towers Against Freezing 63
Draining cooling tower pans eliminated ..... M. Ramsey

COOLING TOWERS
Ground Frozen to Sink Shaft 65
Construction costs cut and work simplified.

ENVIRONMENT ENGINEERING
Reference Section—Control of Excessive Heat in Industry 67
Physics, physiology and engineering control of heat—a symposium.

ELECTRICAL HOOKUPS
Wiring and Control of Refrigeration Compressors 76
Detailed drawings of reciprocating compressor hookups.. W. G. Wassmandorf

REFRIGERATION
Detail Sheet—Wiring Diagrams for Refrigeration Compressors .. 79
City or well water condensing, single or duplex compressors.

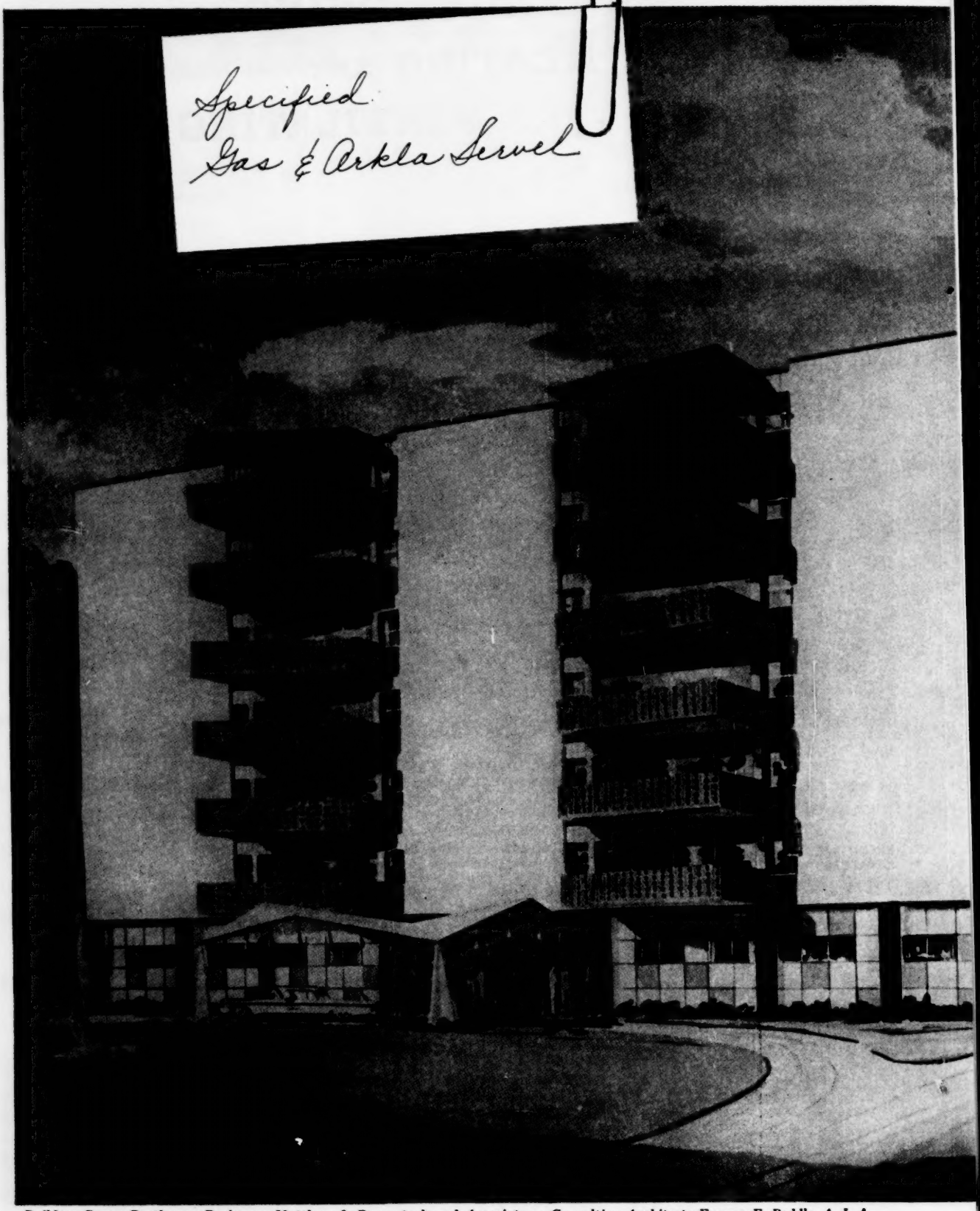
AIR CONDITIONING AND REFRIGERATION
Data Sheet—Pricing Data for Quick Estimating 81
Prices for assessment of a proposed installation.

INTERVIEW
BRI: The Building Industry in 3-D 83
What's in it for our readers.

EDUCATION
Industry Must Train its Engineers 86
One company gives its objectives and results ..... C. J. Brillinger

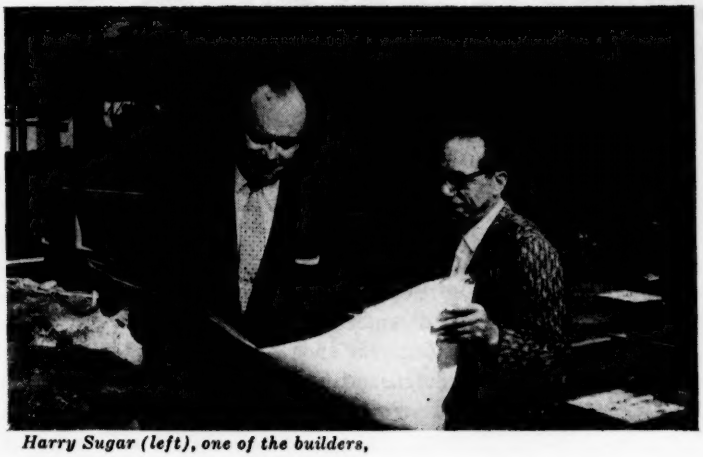
DEPARTMENTS

High Spots in the News 6
Washington Overtones—L. Overman 8
News of the Month 14
Scientific Frontiers 16
Piping and Plumbing—L. Blendermann 88
New Literature 93
New Equipment and Materials 96
Product Applications 114
Degree-Days for September, 1959 116
Coming Events 120
Book Reviews 124
What Readers Say 126
Canadian Degree-Days for September, 1959 128
Briefly Stated News Items .. 129
Index to Advertisers 139
Ad-Digest 143



Builder: Sugar Brothers • Designer: Matthew J. Rosenstock and Associates • Consulting Architect: Eugene F. Peddle, A. I. A.

Akron's 7-story Carlton House to be cooled with individual Arkla-Servel units



Harry Sugar (left), one of the builders, and designer Matthew J. Rosenstock

Individual **GAS** *units to cool and heat new $2 million apartment house*

Akron's luxurious Carlton House will mark the largest use of individual gas air conditioning units in a single apartment house.

Summer cooling and winter heating will be provided for the suites by 58 three-and-a-half and five ton Arkla-Servel Sun Valley gas air conditioners.

The Arkla-Servel gas air conditioning units were chosen after serious consideration of all types available. The designer insisted that each apartment have individual thermostat control as well as individual installations to eliminate the need for large compressors and any possible vibration. Because gas is also used for cooking as well as heating and cooling, there was no need for installing heavy cable, either.

The Arkla units will be installed in the utility rooms of each suite. Four small water towers, located on the roof, will provide condensing water for the system. The water will be constantly recirculated, thus keeping its cost at a minimum.

Check the facts and you too will see that modern Gas air conditioning out-performs all others. For specific details call your local Gas Company's air conditioning specialist, or write to the Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Ark. ***American Gas Association***

for Cooling, **GAS** *is Good Business*

HIGH SPOTS

◗ **Air conditioning will be pumped into homes within the next decade.** Chilled and warm water for maintaining comfortable year-round conditions will be supplied from a central source, like other utilities, according to Charles V. Fenn, Carrier vice-president. The absorption refrigerating machine will provide cooling for the futuristic system. Electronic sensing devices will regulate the volume of hot and cold water in radiation panels, maintaining desired temperature and humidity settings for each room, he said. All residential services will be supplied through underground pipes and wires from an attractive power plant. Steam or hot water from gas-fired boilers, for example, will serve a threefold purpose: winter heating, domestic water needs, and to energize the refrigerating machine for summer cooling.

◗ **Frick Company, Waynesboro, Pa., will continue operations beginning November 1 under the same name and much the same staff but as a subsidiary of General Waterworks Corp., Philadelphia, Pa.** General Waterworks owns and operates water and telephone utility properties in twenty states, together with several industrial subsidiaries making water treatment products. D. Norris Benedict, Frick president, who has been with the company for 58 years, is retiring. He said that the transfer will give Frick more security and permit the company to expand.

◗ **Clark-Cooper Co., Inc., Palmyra, N. J., has acquired and will manufacture and market Webster Moderator Controls,** a line of continuous and pulsating steam controls and continuous hot water heating controls formerly manufactured by Warren Webster & Co., Inc., Camden, N. J. **Warren Webster Company is concentrating its marketing plans and policies in the fields of air conditioning and radiation.** A bi-lateral association between Webster and Clark-Cooper will ensure no break in the distribution by Webster field representatives.

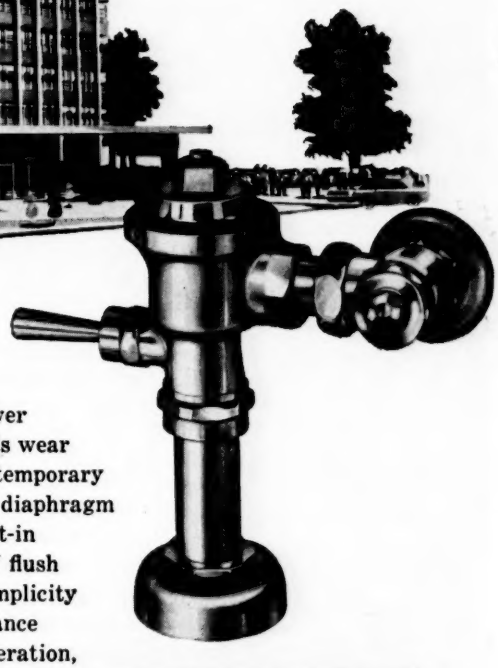
◗ Controls Company of America, Schiller Park, Ill., manufacturer of automatic controls, and Hershel Seder announced that **Milwaukee Valve Company, a subsidiary of Controls Company of America, has sold its business and certain assets to a group of Chicago investors.** Milwaukee Valve is a 58 year old manufacturer of brass and aluminum valves. Controls Company decided to dispose of it in order to devote its funds and talents to its major interest, the controls industry. The new company will continue under the name of Milwaukee Valve Company, Inc. Mr. Seder has been elected its president.

◗ **1959 will go down as the best year yet for sales of unitary air-conditioners,** according to the ARI Unitary Air-Conditioner Section, which has voted to release each quarter a report on manufacturers' shipments. The first report, covering the first six months of 1959, shows a 39% increase in 1959 over the same six months in 1958.

◗ Building research in Japan, Canada, South Africa, etc.; modular construction; new heating techniques; metal curtain walls; documentation of building science literature; and sandwich panel design are scheduled for discussion during Building Research Institute's Fall Conferences, November 17-19 at the Shoreham Hotel in Washington, D.C. **For a clearer understanding of what the Conferences means to the air conditioning, heating and ventilating designer, see BRI: The Building Industry in 3-D, an interview feature that starts on page 83 of this issue.**

And in Boston – A FUTURE OF FAULTLESS SERVICE

THE TRAVELERS INSURANCE COMPANY BUILDING
Boston, Massachusetts
KAHN & JACOBS
architects
JAROS, BAUM & BOLLES
mechanical engineers
GEORGE A. FULLER CO.
general contractor
CRANE PLUMBING PIPE & HEATING COMPANY
plumbing contractor
RIVERSIDE PIPE & SUPPLY COMPANY
wholesale distributor
RICHMOND PLUMBING FIXTURES DIVISION of RHEEM MANUFACTURING CO.
plumbing fixtures manufacturer



Striking use of color is a dominant feature of the sixteen story Travelers office building now nearing completion in Boston with DELANY flush valves installed throughout. Tower and columns are faced with white brick while contrasting spandrels wear a surface of deep blue glazed tile. The net effect is that of a contemporary structure of solidity and substance. For years to come, DELANY diaphragm type flush valves will provide the Travelers Building with built-in insurance against flush valve maintenance headaches. DELANY flush valves command no initial cost premium, yet engineered simplicity and basic design superiority provide an extra margin of performance for the life of the building. Consistent delivery, enduring operation, complete flexibility; all of these characteristics describe DELANY —"the fastest growing name in flush valves!"

DELANY *Flush* **VALVES** Since 1879

COYNE & DELANY CO. • 834 KENT AVE. • BROOKLYN, NEW YORK
IN CANADA: THE JAMES ROBERTSON CO. LTD.

WASHINGTON OVERTONES

by LORING F. OVERMAN

● Omnious overtones in Washington at press time for this column were vibrating from the continuing steel strike.

Gone was the optimistic view that inventories, built up for just such an emergency, would outlast the work stoppage. Instead, steel-users from all levels of industry were readying layoff notices. Overtones of the steelers' differences were all too audible.

Of direct interest to air conditioning and heating-ventilating people was the action of the Business and Defense Services Administration on October 16.

In a new order (Direction 1 to BDSA Order M-1A) both struck and non-struck steel mills were issued new instructions.

Non-struck mills, accounting for some 15% of the nation's steel output, were directed to accord top priority immediately to controlled materials for urgent defense programs.

Struck mills were ordered to heed the instruction immediately upon resuming production.

Projects provided for in the instruction include ballistic missile production, missile launching site construction, and nuclear powered naval vessels.

● A more-than-seasonal decline in September construction totals was tempering what would otherwise have been glad tidings. Building totals for the first nine months of 1959 were 15% above the same period in 1958. Disturbing factor was the drop of 0.4% during the final month of the period.

September outlays for private projects—usually about the same as during August—were 3.0% off. New residential construction was down 2%, although 20.2% above September of 1958, and 30.2% ahead of the corresponding nine month period of '58.

Major exception—and a significant one—was expenditure for private industrial buildings, down 23% for the nine month period.

Residential construction is expected to continue slumping, partly due to tightening of the money supply. This could be offset by increased business and industrial building if the steel matter is concluded.

● When Congress reassembles next January, the question of a national fuels policy may turn out to be one of the most controversial subjects on the agenda.

Forty-three Senators have sponsored a joint resolution urging such a move, and 22 supporting resolutions have been introduced in the House.

During October hearings, proponents cited four reasons for favoring establishment of a policy group:

"It is universally recommended by unbiased experts,

"It is vital to America's defense position,

"It will enable this nation to keep pace with the Soviet economic offense, and

"It will assure a sound dynamic economy."

Opponents hold that favorable action on the resolution would be the first step toward setting up end-use controls of natural gas.

Coal industry spokesmen counter that coal, as a solid fuel and by conversion to liquid and gaseous forms, could supply most of the country's needs for energy.

Probable coal reserves of 4,950 trillion tons exist in the world—2,100 trillion tons in the United States—a Congressional subcommittee was told by a University

(Continued on page 10)

THE WARREN WEBSTER MAN BRINGS THE SOLUTION TO YOUR HEATING AND COOLING PROBLEMS

Wherever you are, whatever your "thermal environment"—there's a Webster product to assure year-round heating and cooling comfort . . . a Warren Webster Man ready to help you into the Comfort Zone.

Let him study your specific problems and recommend the Webster products that most efficiently meet your comfort requirements. He's pledged to see to it that your installation is right . . . and that it stays right . . . always. The Webster Mobile Demonstrator shows Webster heating and cooling equipment in operation. He'll be glad to advise you when it visits your area.

In the hands of your Warren Webster Man, product dependability and customer service come first. Whatever your heating and cooling problem, call on him . . . today.

WARREN WEBSTER & COMPANY, INC.

HEATING • COOLING

HOME OFFICE & FACTORY, CAMDEN 5, NEW JERSEY • REPRESENTATIVES IN PRINCIPAL CITIES

WASHINGTON OVERTONES *(Continued from page 8)*

of Maryland professor. In addition, he said, there are 1,285 trillion tons of lignite, with 850 trillion tons in North America. Even after allowing for losses in mining processes, the Maryland spokesman said, reserves of coal and lignite are probably 20 to 30 times larger than those of other fuels.

● Sales of unitary air-conditioners during the first six months of 1950 were 39% ahead of the same period in '58. The figure, coupled with projections for summer months, indicates that "1959 will go down as the best year yet for sales of unitary air conditioners", the Air Conditioning and Refrigeration Institute reports.

The half year ARI report shows that the greatest gain, 106%, was in the 42,000 to 53,999 Btu per hr sizes. Only loss in the group, 15%, was shown by the 185,000 to 249,999 Btu per hr range. Second largest gain, 97%, was in the second largest group of sizes, 320,000 to 379,999 Btu per hr.

● Internal Revenue Service officials have been asked to clarify definitions of self-contained air conditioners as taxable under the 10% excise tax levied in 1941 as a war-financing measure, and never repealed.

By brief and personal appearance, the Air Conditioning and Refrigeration Institute made two suggestions. It urged IRS to more clearly define "self-contained" by making the regulation read, "designed for the free delivery of air without ducts for conditioned air and for removal of heat."

Also urged is amendment of another sub-paragraph to read, ". . . is designed for use as a portable unit, console unit, or for installation in or in front of a window or other outside opening through which the removed heat is discharged without ducts or other special connections."

● A monthly summary of stocks of residual fuel oil held at refineries, bulk plants and bonded bunkers in District I and parts of District III will be collected and published by the Oil Import Division, Department of the Interior.

For 36 importers of residual fuel oil, reporting will be mandatory.

Voluntary reports will be requested of 100 non-importers. Companies have also been sent a form for a one-time report on historical stock levels for 1957-1959. Individual reports will not be publicized.

● A Bureau of Mines report reveals that land in the public domain bordering the Arctic Ocean in northern Alaska contains millions of barrels of recoverable crude oil. Estimates are that 122-million barrels of oil can be extracted by primary production methods.

● Encouraged by the success of its program of certifying unitary air conditioners, ARI has announced a similar plan for unitary heat pumps. The new program will be based on testing and rating in accordance with ARI Standard 240, which the Unitary Section will revise to bring it up to date in reference to Standards of ASA, Underwriters' Laboratories, and particularly to the proposed new ASHRAE Standard Method of Testing Rated Heat Pumps.

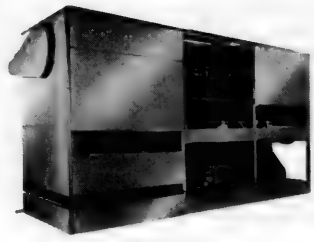
The new program, to be established during 1960, but no later than 1961, provides for publication of ratings certified to ARI by manufacturers. Participating companies will sign contracts with ARI for testing and rating procedures and will be authorized to use the ARI certification seal on heat pumps so long as they are tested and rated in compliance with the Standard.

● Manufacturers' shipments of compressor bodies during the first five months of 1959, for all used excepting household refrigerators, totaled 2,582,694 units, compared with 1,806,180 in the same period of 1958. The gain was 43%.

CITIES SERVICE OIL COMPANY — ROMA WINE COMPANY — ALLEN B. DUMONT LABORATORIES, INC — AMERICAN AIRLINES, INC — GENERAL SERVICES ADMINISTRATION — J. M. FIELDS STORES — U. S. ARMY — FROZEN RITE, INC — PACIFIC TELEPHONE & TELEGRAPH COMPANY — TEXAS FASTENER CORPORATION — RONEY PLAZA HOTEL — UNIVERSITY OF SOUTHERN CALIFORNIA — PHILLIPS PETROLEUM COMPANY — CHICAGO BRIDGE & IRON — GENERAL ELECTRIC — ATLANTIC & PACIFIC TEA COMPANY — ROBERT HALL CLOTHIERS — HUMBLE OIL COMPANY — OLIN MATHEISON — LOCKHEED AIRCRAFT AREOJET — SYLVANIA ELECTRIC — F. W. WOOLWORTH COMPANY — KAISER ENGINEERING CORPORATION — U.S. NAVY SAFEWAY STORES — CONVAIR — ATOMIC ENERGY COMMISSION — CONTINENTAL BAKING COMPANY — REPUBLIC AVIATION — FOOD FAIR STORES — NATIONAL CASH REGISTER — BURROUGHS CORPORATION — FEDERAL HOUSING ADMINISTRATION — EDISON COMPANY — RAND McNALLY & COMPANY — MINNESOTA MINING & MANUFACTURING BANK OF AMERICA — U.S. AIR FORCE — NEW YORK [illegible] COMPANY — FRANKLIN STORES — NATIONAL FOOD STORES — CENTRAL CASUALTY INSURANCE COMPANY [illegible] C COMPANY — PACIFIC GAS & ELECTRIC — RADIO CORPORATION OF A [illegible] KY LAGER BREWING GENERAL [illegible] T STORES SEARS & [illegible] — STATE FARM INSU[illegible] - MUZAK CORPORAT[illegible] PORATION BOND STO[illegible] NSURANCE COMPANY [illegible] REFINING COMPANY [illegible] COMPANY NEW ENGLAND TELEP[illegible] LONIAL STORES, INC. GLENN MANUFACTURING COMPANY — CURTIS WRI[illegible] EL MUNDO, INC. — U. S. PLYWOOD — FORD MOTOR COMPANY OF CANADA, LTD. — DIPLOMAT HOT[illegible] ILD CAMERA & INSTRUMENT COMPANY — AMERICAN THERMOS PRODUCTS — PACIFIC MURPHY MANUFACTURING CORPORATION — THE MAYTAG COMPANY — INTERNATIONAL BUSINESS MACHINES — NATIONAL BISCUIT COMPANY — ASIATIC PETROLEUM CORPORATION — INSULAR CHEMICAL COMPANY STANDARD LIFE & ACCIDENT COMPANY — EASTMAN KODAK COMPANY — UNIVERSITY OF OKLAHOMA — BELL AIRCRAFT MONARCH METALS WEATHERSTRIP COMPANY — McDONNELL AIRCRAFT CORPORATION — BETHLEHEM STEEL COMPANY — B-THRIFTY STORES, INC. — WAYNE PUMP COMPANY — ARMA CORPORATION — THREAD, INC. — AMERICAN OIL COMPANY TRANSCON FREIGHT LINES — AMERICAN CAN COMPANY — KANSAS CITY FIRE AND MARINE INSURANCE COMPANY — T G & Y STORES — BRITISH OVERSEAS AIRWAYS CORPORATION — RAND McNALLY & COMPANY — NEW YORK TELEPHONE COMPANY WESTERN ELECTRIC COMANY — AMERICAN MACHINE & FOUNDRY — W. T. GRANT COMPANY — PIGGLY-WIGGLY FOOD STORES J. C. PENNEY COMPANY — PENN FRUIT STORES — RUTGERS UNIVERSITY — U. S. MARINE CORPS — HOWARD JOHNSON'S KROGER COMPANY — CIVIL AERONAUTICS ADMINISTRATION — E. I. DuPONT De NEMOURS & COMPANY — SAHARA HOTEL

GOVERNAIR

GOVERNAIR PRODUCTS ARE NOW IN USE BY THESE DISTINGUISHED ORGANIZATIONS



Model SCMZ

Self-contained Multi-Zone air conditioner — one of 18 basic Self Contained equipment models, available from 3 to 120 tons.

Model GMZ

Governair also "Satisfabricates" a complete line of Vertical, Horizontal and Multi-Zone Air Handling Units.

"SATISFABRICATED"®

. . . that's the copyrighted term that describes Governair air conditioning . . . equipment which is so basically flexible in design, that it can be manufactured to fit almost *any* space and load requirement.

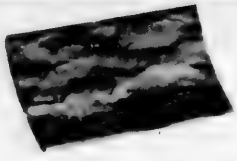
This beneficial feature, pioneered and developed by Governair, is coupled with imaginative, tested engineering and quality workmanship. The end result is an installation that's a much *wiser* dollar investment.

Write for detailed information, or consult your yellow page directory for the name of our local representative.

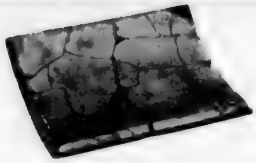
THE GOVERNAIR CORPORATION

4840 N. SEWELL • OKLAHOMA CITY

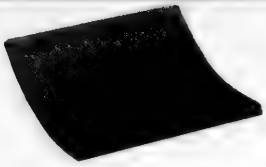
SPECIAL CEMENT LINING
for storage water heaters



Plain steel plate corrodes even under normal water conditions.



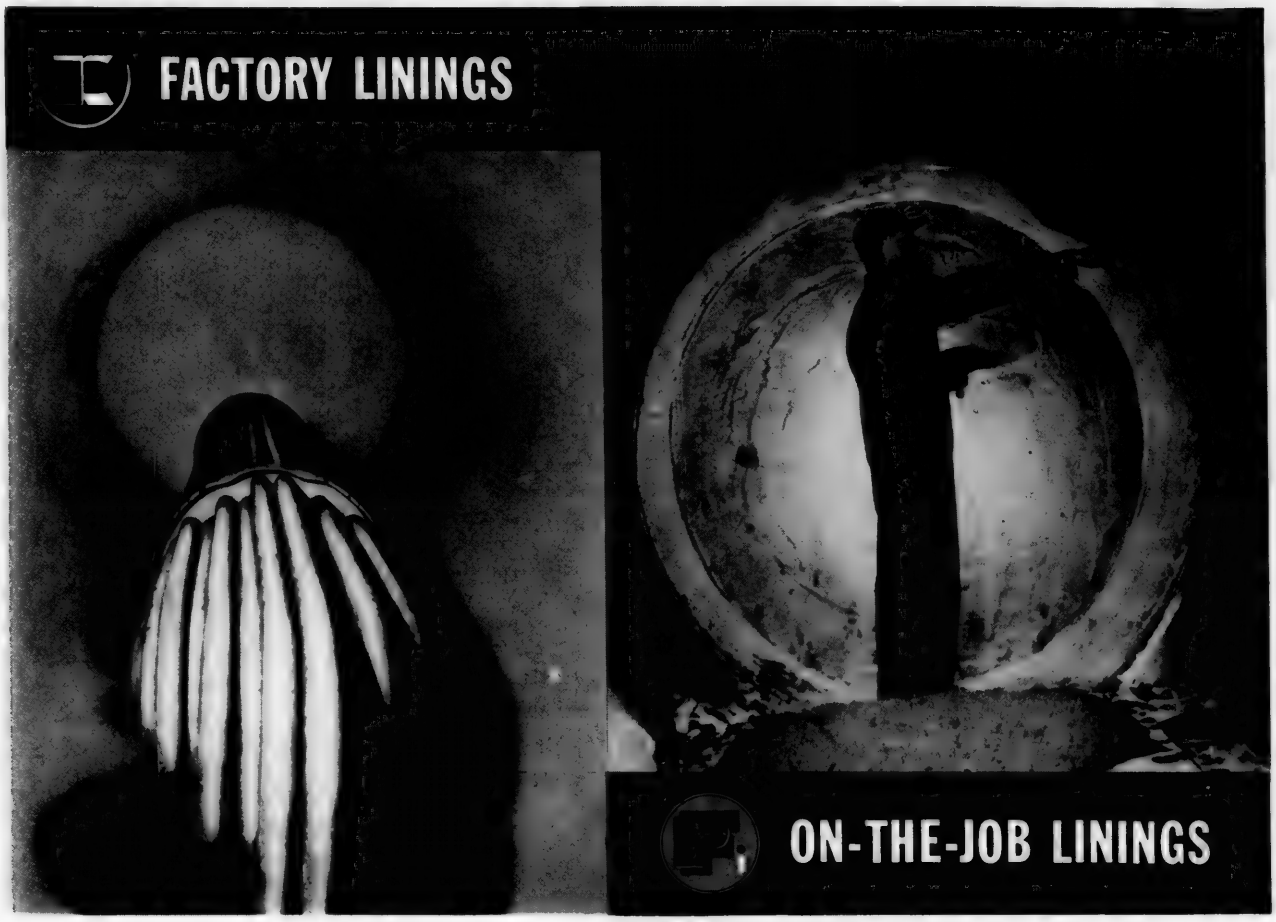
Ordinary cement linings tend to flake, crack and shrink, resulting in high maintenance costs.



Pre-Krete lining remains in perfect condition after exhaustive testing.

SPECIAL FORMULA C-17 PRE-KRETE is a rust and corrosion resistant hydraulic cement lining for steel storage water heaters. It is extraordinary in composition and uniformity. With the aid of special additives, it doesn't chip, crack or flake even at temperatures up to 900°F. Still more important, it is blended in Twin-Shell blenders designed, developed and patented by P-K. An intimate uniformity results that prevents weak spots or "holidays." Maintenance costs are lowered appreciably.

FACTORY LININGS. A P-K Pre-Krete lined water heater costs only slightly more than a plain steel heater, lasts twice as long! A strong, durable ¾" coating is applied, including manhole, coverplate and heating element nozzle. All materials and workmanship are fully guaranteed. And you get



thermal designing that has maintained an unexcelled reputation for over 75 years, plus advanced fabrication techniques that meet all ASME specifications.

ON-THE-JOB LININGS of Pre-Krete give corroded steel vessels – open as well as closed – a long, new life. Unconditionally guaranteed applications are made by franchised applicators of Pocono Fabricators Inc., a division of Patterson-Kelley. Downtime for lining an average vessel: about 48 hours. Also available for "Do-it-yourself" application.

We'd be glad to send descriptive catalogs and more information. Just write, telling us whether you would like to know about new factory lined storage water heaters or on-the-job linings. Address Patterson-Kelley Co. Inc., East Stroudsburg, Pa.

FRANCHISES AVAILABLE. A few Pre-Krete franchise territories remain open in our nationwide network. Franchised applicators are carefully chosen. We'd appreciate your recommendations.

Patterson Kelley

Water Heater Division

storage water heaters • instantaneous heaters • convertors • freon waterchillers • water to water exchangers • gas fired storage water heaters

NEWS OF THE MONTH

ARI HEAT PUMP CERTIFICATION TO START NO LATER THAN 1961— UNITARY SECTION WILL BRING STANDARD UP TO DATE

A certification program for unitary heat pumps will be inaugurated by Air-Conditioning and Refrigeration Institute, Washington, D.C., to parallel the already operative and highly successful certification program for unitary air-conditioners. The program will be based on testing and rating in accordance with ARI Standard 240, which ARI's Unitary Section will revise in order to bring up to date its references to Standards of ASA, Underwriters' Laboratories, and particularly to the proposed new ASHRAE Standard Methods of Testing for Rating Heat Pumps.

Certification of unitary air-conditioners is based on testing and rating of units in compliance with ARI Standards 210 (for electrically-powered units) and 250 (for heat-operated units). Both of these standards are undergoing revision also, along the same lines as Standard 240.

Because of the necessity for revising Standard 240, and other technical details, there will be some delay in making the heat pump certification program effective, but it is hoped that it will be underway sometime in 1960, and certainly no later than January 1, 1961, it was pointed out by Frederick J. Reed, ARI chief engineer.

When inaugurated, the heat pump program will provide, as does the unitary air-conditioner program, for testing and rating by manufacturers and reporting ratings to ARI, for publication of ratings in an official ARI Directory, for random testing of units on the market by an independent testing laboratory under contract to ARI, and for special tests on units on which complaints have been lodged. Participating companies will sign contracts with ARI for the testing and rating procedures, and will be authorized to use the ARI Seal of Certification on unitary heat pumps so long as they are tested and rated in compliance with the standard.

An October 1 edition of the Directory of Certified Unitary Air-Conditioners, the final 1959 issue of the Directory under the unitary air-conditioner program, has been issued. It contains the names of fifty-one participating companies, with the certified ratings of all unitary air-conditioners produced by them.

Sea water conversion evaporator measures 70 ft, weighs over 40 tons. The Cleaver-Brooks unit will produce over 100,000 gal per day of potable water in conjunction with Southern California Edison's steam electric power plant near Oxnard, Calif.

NATIONAL WARM AIR CONVENTION TO GET VIEWS ON ELECTRIC HEAT

The viewpoints on electric heating of the ducted air heating and cooling industry, and that of the electric industry will be aired during the 46th Annual Convention of National Warm Air Heating and Air Conditioning Association in St. Louis, Mo., scheduled for December 2nd, 3rd, and 4th.

Discussion of the Association's Silver Shield Program will share the program on Thursday morning, December 3rd, with a two-sided discussion of electric heating; John Morris, president of Lennox Industries, will present the view-point of the ducted air heating and cooling people; Edwin O. George, vice president of Detroit Edison Company and chairman of the Sales Division Executive Committee of Edison Electric Institute will describe the plans and attitudes of the electric industry.

A summary of research activities and findings during the past year will be made by Keith T. Davis, Bryant Manufacturing Company, and Edward J. Brown, research associate in mechanical engineering at the University of Illinois, both of whom are officials in the 41-year old industry-academic research program sponsored by the Association.

This convention will be the first during the tenure of James M. Martin, who was named managing director of the Association, effective November 1. He succeeds George Boeddener, who stepped down after twenty years with the trade group.

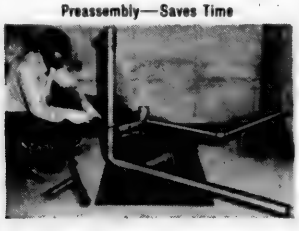
Mr. Martin has been associated with National Warm Air for ten years, the last three in an administrative capacity. According to Association president Tom Byrd, Mr. Boeddener is responsible for having increased, "nearly beyond measurement," the recognition membership, and activities of the group. During his twenty-year tenure, the Association's combined membership of dealer-contractors, wholesalers, and manufacturers has increased from 150 to 3000, its budget from $20,000 in 1940 to one exceeding one-quarter of a million dollars annually.

LIGHTWEIGHT COPPER TUBE IS EASY TO INSTALL. Only *one fourth* the weight of ferrous materials—one man lifted and connected this long length of 6-inch copper drainage tube. Overhead work is easier with Anaconda copper tube—no heavy equipment for threading or caulking. In close quarters, copper tube and solder-joint fittings make light work out of tight work. Use this lightweight modern drainage tube—Anaconda copper tube—for your next drainage installation. For more information on copper tube, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA® **COPPER TUBE AND FITTINGS for soil, waste and vent lines**
Available through plumbing wholesalers. Products of The American Brass Company

Longer Lengths—Fewer Joints

Preassembly—Saves Time



Lightweight Copper—Easier Installation

Compact Connections—Save Space

Scientific Frontiers

Fuel Cells

Civilization gets most of the energy it consumes from the energy of the chemical bonds in coal, petroleum and natural gas. But, according to Leonard G. Austin, writing in the October issue of *Scientific American,* in the process of putting that chemical energy to work, it throws most of it away. The energy is first converted, by combustion of the fuel, into heat. The heat is then converted, by several kinds of heat engine, into mechanical energy, which may in turn be converted into electricity. These transformations yield less than half of the original energy as useful work. But the fault does not lie in the energy-converting machines. Though the most modern central power-stations manufacture electricity at an efficiency of only 35 to 40%, the performance of boilers, turbines and generators has been improved over the years until it now approaches the maximum which can be expected from the heat-steam-electricity cycle. Internal-combustion engines have reached a corresponding peak of efficiency at 25 to 30%, and high-temperature gas turbines are approaching their limit at 40%. The ceiling on efficiency is partly imposed by the second law of thermodynamics, which dictates the downhill flow of energy throughout the cosmos. At the operating temperatures of heat engines —temperatures set by the strength of materials and the economics of heat transfer—this law decrees that more than half of the original chemical energy must be lost in irrevocably wasted heat. Further energy is lost to the friction that is encountered in any machine.

With conventional energy-converting technology approaching a dead end, power engineers are seeking ways to by-pass the heat cycle and to convert the chemical energy of fuels directly into electricity.

The first voltaic pile and its modern descendant, the dry battery, are fuel cells in a sense: they convert chemical energy directly into electricity. But they use expensive "fuels" such as zinc, lead or mercury that are refined by the expenditure of considerable energy from fossil fuels or hydroelectric power. A true fuel cell uses the basic fuel directly, or almost directly. In theory the fuel cell may approach 100% efficiency in converting the chemical energy of the fuel into electricity; actual efficiencies of 75%—more than twice that of the average steam power-station—are considered quite feasible.

The realization of these attractive possibilities will require a great deal of development work. To understand some of the difficulties to be surmounted, let us consider the fuel cell in which hydrogen and oxygen combine to produce an electric current and water.

The hydrogen-oxygen fuel cell consists of two porous electrodes separated by an electrolyte, which in this case is a concentrated solution of sodium hydroxide or potassium hydroxide. On the negative side of the cell, hydrogen gas diffuses through the electrode; hydrogen molecules (H_2), assisted by a catalyst embedded in the electrode surface, are adsorbed on the surface in the form of hydrogen atoms (H). The atoms react with hydroxyl ions (OH^-) in the electrolyte to form water, in the process giving up electrons to the electrode; the water goes into the electrolyte. This reaction is also aided by the catalyst.

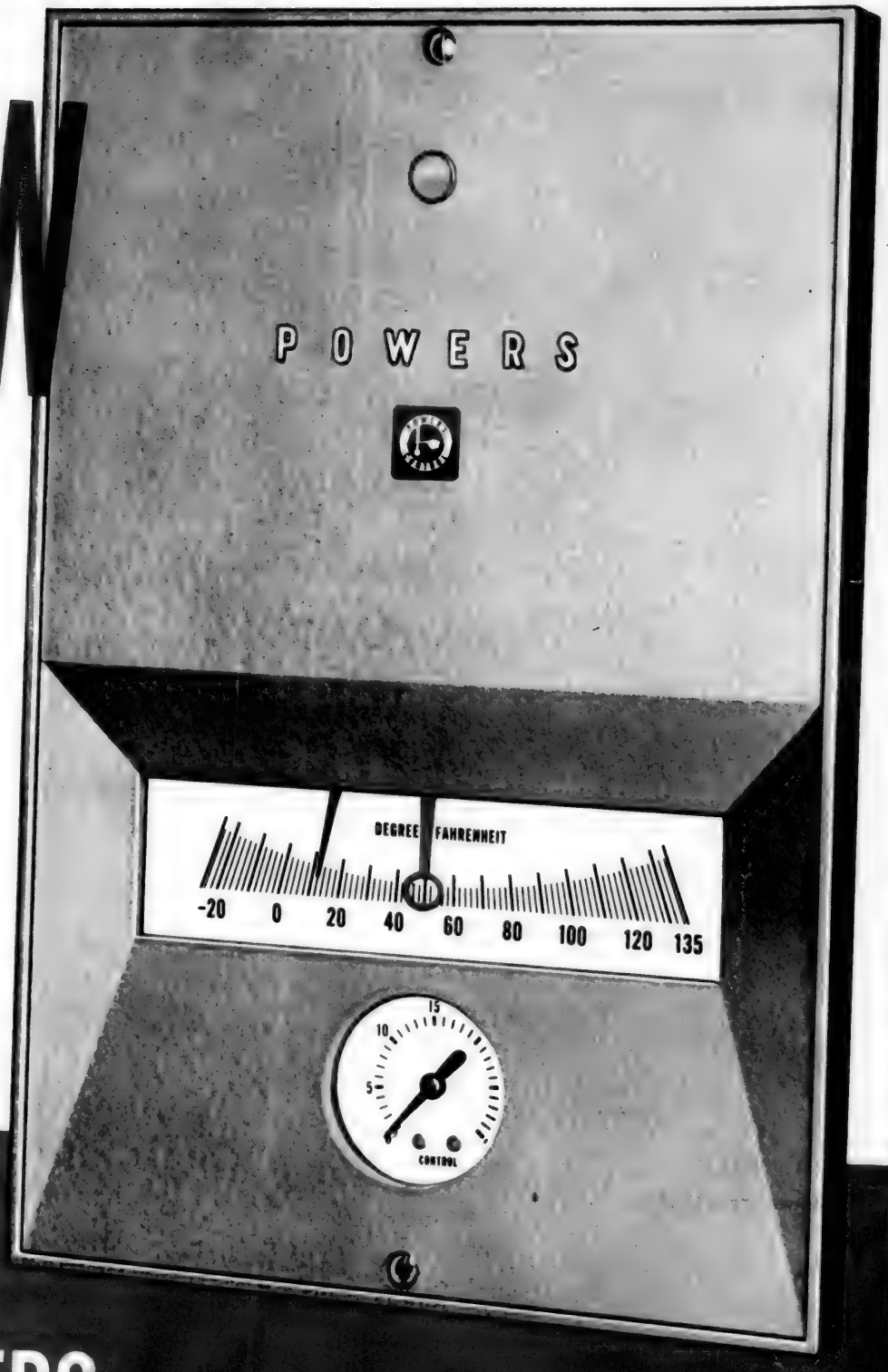
The flow of these electrons around the external circuit to the positive electrode constitutes the electric output of the cell and supports the oxygen half of the reaction. On the positive side of the cell oxygen (O_2) diffuses through the electrode and is adsorbed on the electrode surface. In a somewhat indirect reaction the adsorbed oxygen, plus the inflowing electrons, plus water in the electrolyte, form hydroxyl ions. Here again a catalyst helps the reaction to proceed. The hydroxyl ions complete the circle by migrating through the electrolyte to the hydrogen electrode.

To produce economical power on a large scale, fuel cells must "burn" cheap fuels such as natural gas, vaporized gasoline or the mixture of gases obtained from these gasification of coal. The extraction of energy from such fuels calls for operating temperatures above 500 deg C. Since aqueous electrolytes would boil away at these temperatures, the electrolyte consists of some molten salt, usually a carbonate of sodium or potassium mixed with lithium carbonate to lower the melting point. In the most efficient of these cells, the electrolyte is held in a matrix of porous refractory material. The electrodes, made of a variety of metals or metallic oxides, are tightly pressed against the "solid" electroylte.

In these cells the fuel does not necessarily combine directly with oxygen as hydrogen does in the hydrogen-oxygen cell. Usually the fuel is "cracked" to hydrogen and carbon monoxide by reaction with steam and carbon dioxide, which the fuel cell produces as by-products. This cracking may be conducted outside the cell, or inside the cell on the electrode surface. In the current-generating reaction the hydrogen and carbon monoxide diffuse into the cell as the native electrode, where they react with carbonate ions in the electrolyte, forming carbon dioxide and water and giving up electrons to the electrode. At the positive electrode, oxygen or air takes up the electrons flowing in from the external circuit and reacts with the carbon dioxide to produce the carbonate ions. The migration of carbonate ions through the electrolyte from the positive to the negative electrode completes the circuit.

High-temperature fuel cells, intensively investigated only since World War II, still perform poorly, according to Mr. Austin. The best of them produce no more than half a kilowatt per cubic foot—half the yield of the low-temperature hydrogen-oxygen cell, and one-twelfth the yield of the Bacon cell, a hydrogen-oxygen cell operating at higher temperatures and pressures. However, the progress already made in hydrogen-oxygen cells suggests that further research can improve the performance of the high-temperature fuel cells by a factor of 10 or more.

NEW

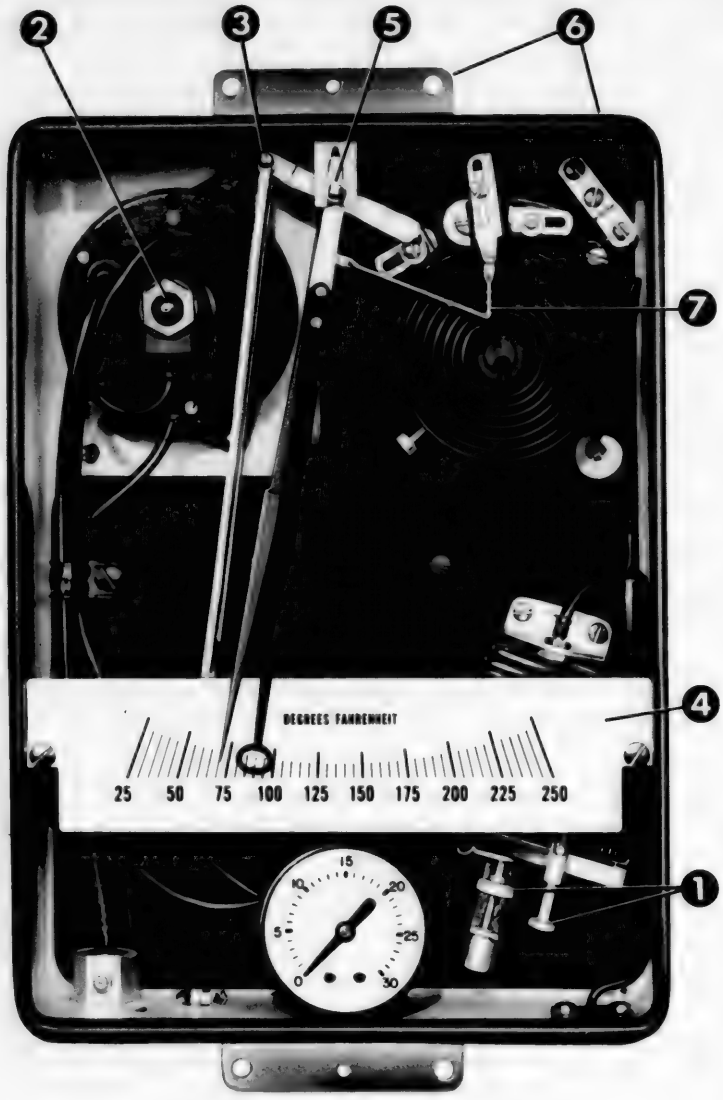


"Precise Control, Easy-to-Read Scale, Simple, Easy to Adjust, Service or Maintain. Reliable."

"Attractive Modern Design too!"

POWERS

NOW–You Can



Check these POWERS QUALITY FEATURES

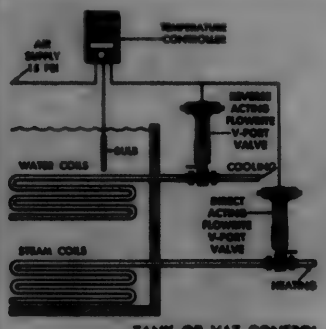
1. 0 to 35% adjustable throttling range and manual rest.
2. Ingenious new pilot valve design. Sapphire restriction and push button restriction cleaner. Cartridge filter for easy replacement. Non bleed design results in lowest air consumption.
3. Linkage design with captive screw principle. This prevents linkage connections from being jarred loose—yet permits easy reversing of linkages.
4. Large, easy-to-read-scale—a full 5⅜ inches.
5. Control point knob for concealed or external adjustment.
6. Universal mounting (flush or surface), bottom connections. Sturdy drawn metal case. Gasketed die cast cover has metallic gray enamel finish.
7. Automatic correction for change in ambient temperature around capillary and case.

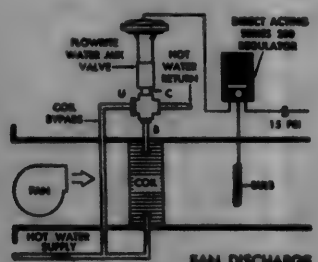
POWERS Series 200 Temperature Indicating Regulator

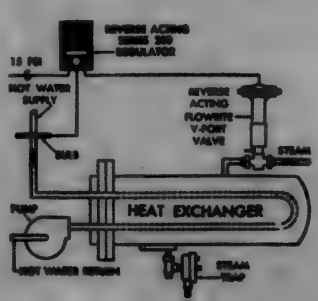
A pneumatic instrument designed for precise control of diaphragm valves, damper motors, Submaster Regulators and other devices used to control heating or air conditioning systems and processes. Various temperature ranges and bulb styles are available and described in Bulletin 370-1.

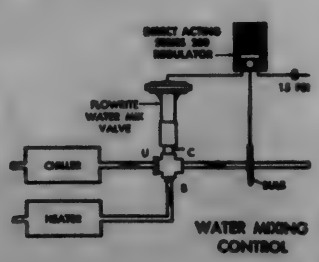
Cover Dimensions: 12¾" high x 8¾" wide x 3½" deep

Some typical applications of Series 200 Temperature Indicating Regulators









Specify a POWERS CONTROL SYSTEM
that will include SERIES 200 Instruments

Compare their better control features that insure better performance.
They're easy to adjust, service and maintain.
Note their modern styling and simplicity.

Pressure Regulator

Powers Series 200 Pneumatic Control Instruments—meet the demand for precise control combined with a modern case design for mounting on centralized control panels. They were especially designed for applications in heating and air conditioning systems and industrial processes which require indicating regulators with the simplicity and time proven reliability of pneumatic control.

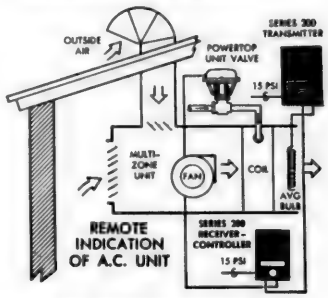
Series 200 Transmitter and Receiver-Controller combination provides the most accurate control obtainable where distances are too great for effective use of conventional thermal systems. The transmitter measures temperature in ducts, pipe lines or tanks and converts it into a 3 to 15 psi air pressure signal. This signal is transmitted to a remotely located pneumatic receiver-controller which indicates and maintains the temperature for which it was set, by regulating valves, dampers, sub-master regulators or other devices. Bulletin 371 gives further information about Powers transmission equipment.

Series 200 Pressure Regulator—Wherever the precise indication and control of liquid, gas or vapor pressure is required this regulator is available in four standard ranges covering pressures between 30 inches (HG) vacuum to 350 psi. It has 0% to 35% adjustable sensitivity and manual reset. Bulletin 356 gives further information.

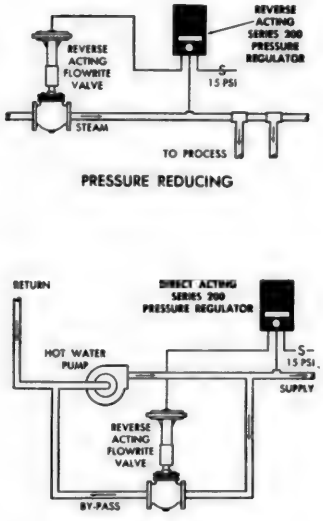
Series 200 Submaster Regulator—is a temperature indicating controller whose control point can be readjusted by a remotely located master control—a thermostat, hygrostat, pressure regulator or a manual positioning switch. See typical applications below. Bulletin 303-1 gives further information.

Call Your Nearest Powers Office for further information about these quick response, precision controls or write us direct.

Temperature Transmitter



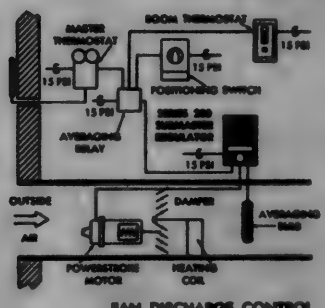
Series 200 Receiver-Controller



PRESSURE REDUCING

PUMP – BY-PASS CONTROL

Some typical applications of

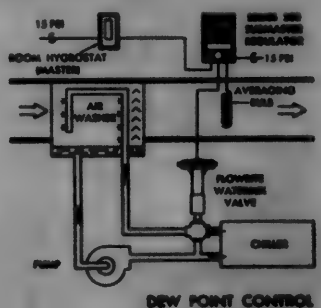


FAN DISCHARGE CONTROL

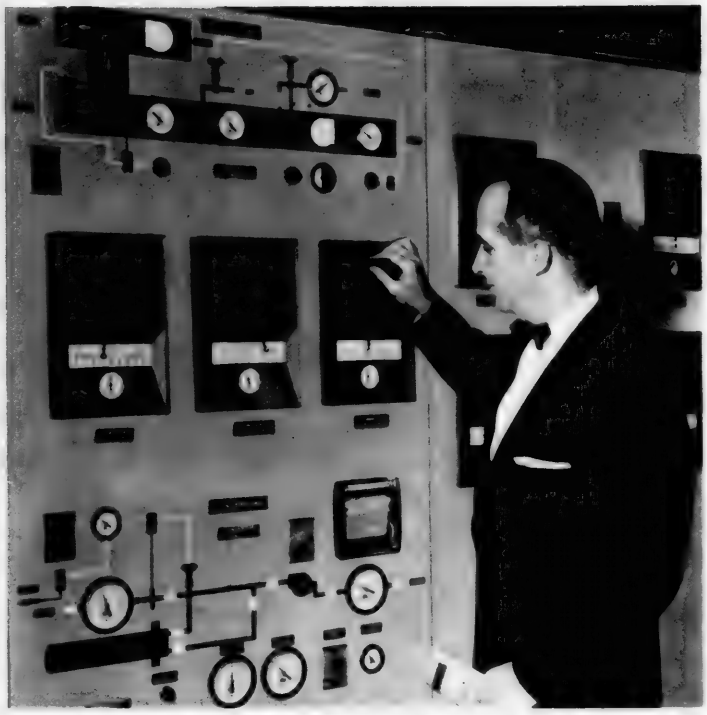
Submaster Regulator

Series 200 Submaster Temperature Regulators

Temperature averaging bulb
Other types available.



DEW POINT CONTROL



POWERS Series 200 Instruments — are Compact, Easy to Adjust, Have Large Easy to Read Scale, and Modern Design.

They are ideally suited for control panels. Durable metallic gray enamel finish has a pleasing appearance and is easy to keep clean.

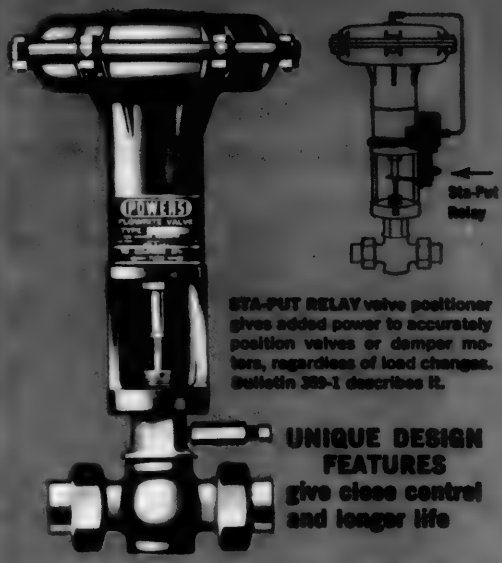
Quality Assurance at POWERS

Each control instrument is checked out and inspected step by step to assure good workmanship and precision performance.

Optical Comparator at left is only one of the many aids used in controlling the high level of precision at Powers. The silhouette of a machined part may be enlarged over 50 times for critical inspection.

Powers FLOWRITE Valves

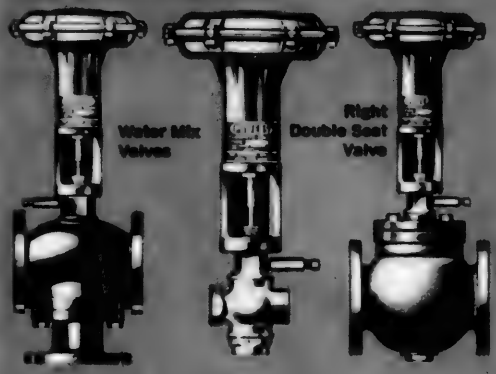
Compressed Air or Water Operated



STA-PUT RELAY valve positioner gives added power to accurately position valves or damper motors, regardless of load changes. Bulletin 329-1 describes it.

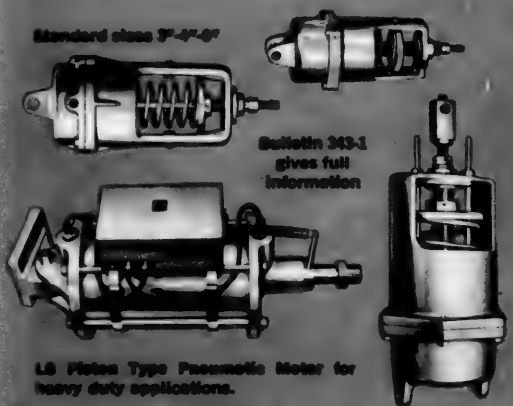
UNIQUE DESIGN FEATURES give close control and longer life

Characterized V-port Valve gives straight line flow thru-out valve travel. Renewable stainless steel poppet and separate shut off seat reduces wire drawing and insures tight shut off. Bulletin 344-V gives further information.



Powers Type 885 TEFLON Asbestos Packing, reduces maintenance, prolongs valve life—is used in all Powers Valves. Bulletins 344-S describes single seat valves, 344-DS Double seat Valves, 344-WM Water Mixing Valves.

Powers POWERSTROKE Piston Motors for pneumatically controlling various types and sizes of dampers and industrial operations.



THE POWERS REGULATOR COMPANY • Skokie Ill. • Offices in 85 Cities

PRINTED IN U.S.A.

THE BIG ONES COME TO BURNHAM

Stewart House Apartments—New York City
Diesel Construction Co., Inc., N. Y. C. . . *Builder and General Contractor*
Sylvan and Robert Bien, New York City . . . . . *Architects*
Sears and Kopf, New York City . . . . . *Consulting Engineers*
J. E. Schecter Corp., New York City . . . . . *Heating Contractor*

NEW LUXURY APARTMENTS TO HEAT WITH BURNHAM COMPACT-TYPE STEEL BOILERS

Filling an entire city block, Stewart House is one of the largest fine apartment buildings going up in New York City this year. A luxury co-op, it stresses quality throughout. To provide maximum heating capacity in minimum floor space, Burnham Compact-Type Steel Boilers were chosen. Three boilers will be used, each with a capacity of 38,750 sq. ft. E.D.R. normal steam, new S.B.I. rating. Burnham's Compact-Type Welded Steel Boilers are available in new S.B.I. ratings from 2,930 to 39,370 sq. ft. net E.D.R. steam, with comparable ratings for water. Specify them on your next job where space-saving and quality are important.

Burnham also offers a complete line of Scotch-Type and Scotch-Type Package Boilers in the above ratings and in certified ratings with up to 4,000 sq. ft. of heating surface.

Burnham Corporation

Steel Boiler Department
Irvington, New York

Sales Representatives throughout the U. S. A.

MEMBER

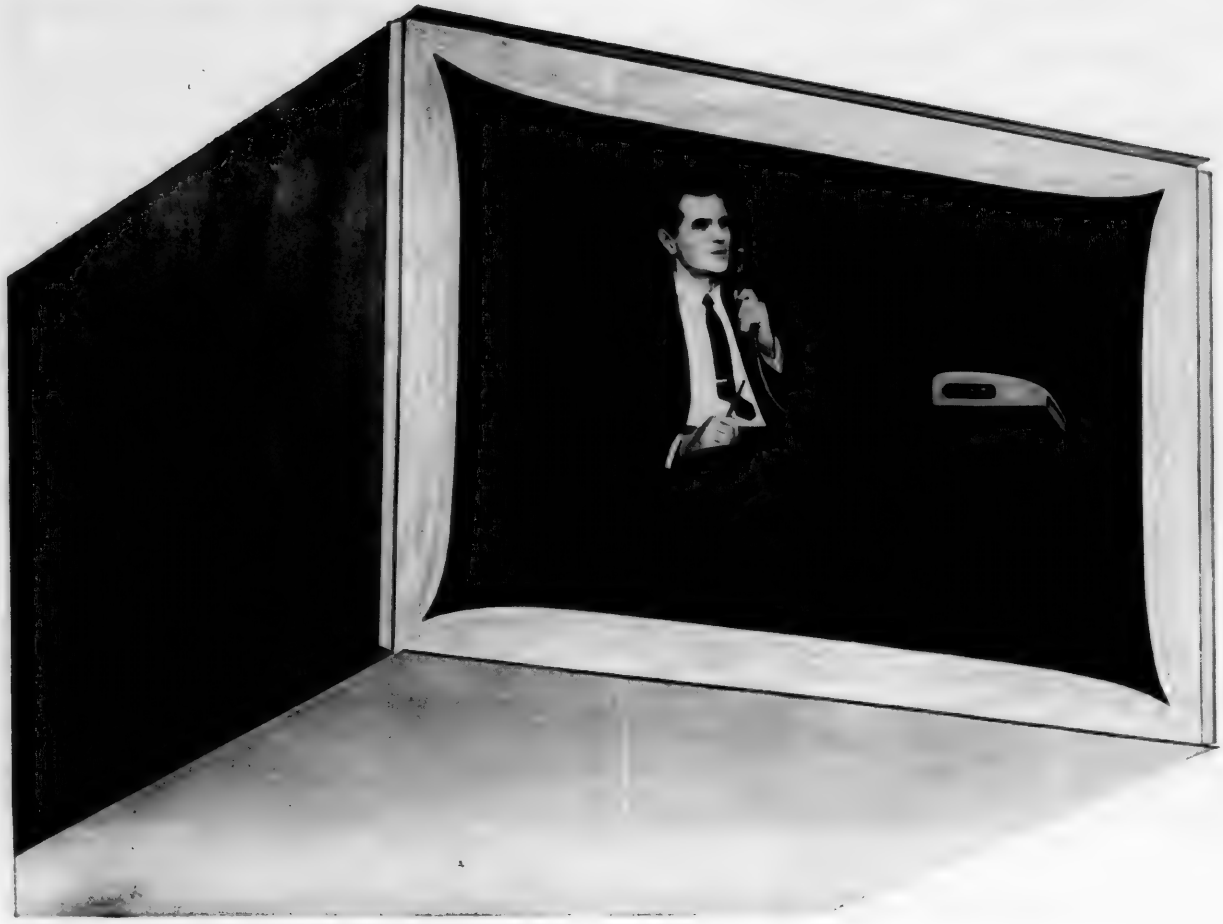
Burnham Corporation ACH-119
Steel Boiler Department
Irvington, New York

Please send me, without obligation, full ratings and data on:
Compact Boilers ☐ Scotch-Type Boilers ☐ Boiler-Burner Packages ☐

Name . . . . . .

Address . . . . . .

City . . . . . State . . . . . .



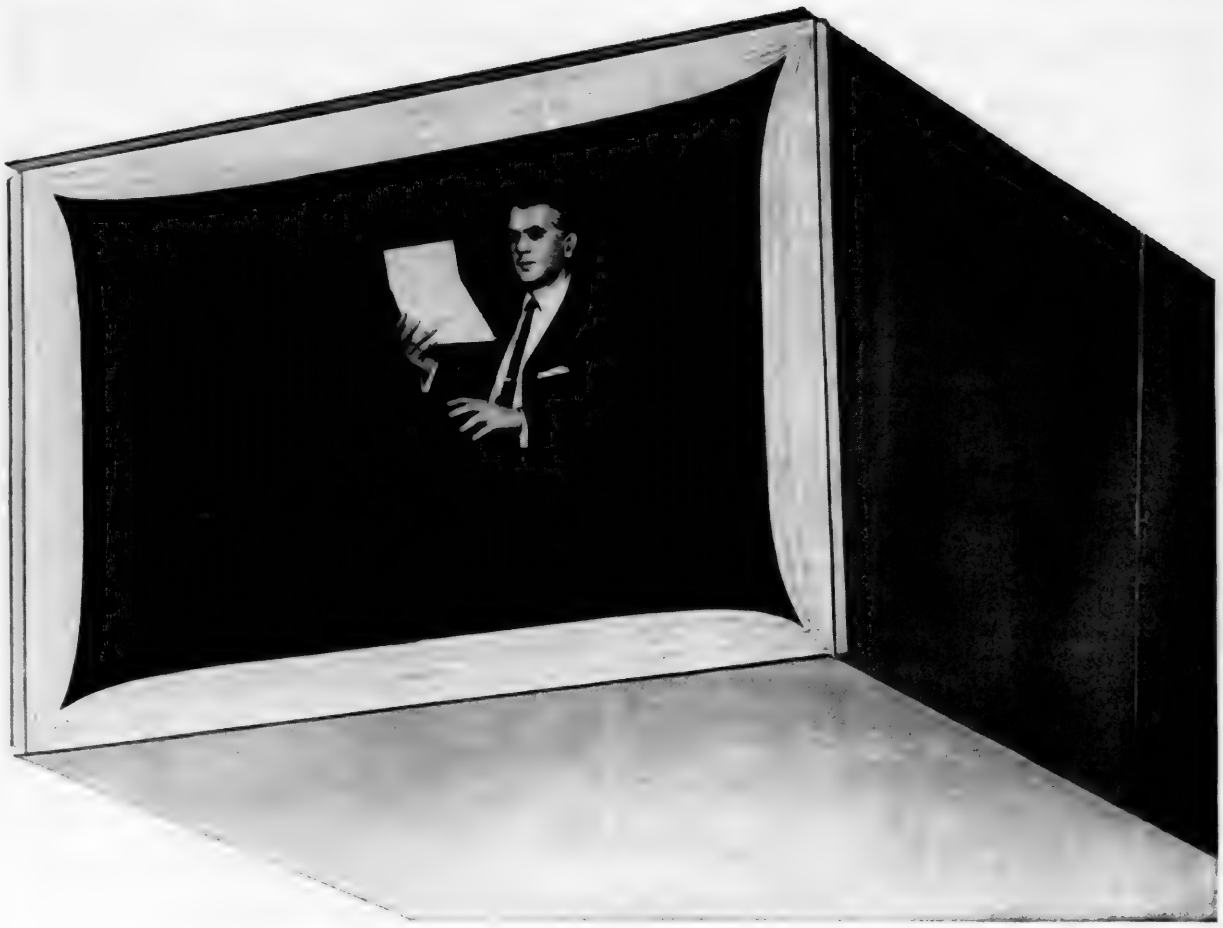
Keeps air ducts quiet . . .

J-M Microtex® fiber glass duct liner does

MICROTEX—
another quality
Johns-Manville
Fiber Glass product

WHY YOUR INSTALLED COSTS ARE LOW WITH JOHNS-MANVILLE MICROTEX . . .

- **LIGHTWEIGHT MATERIAL.** Easy to handle in the shop.
- **RESILIENT.** Can be formed with the metal in the brake.
- **STRONG.** Holds up during shop handling. Won't pull apart. Less waste.
- **EASY TO CUT AND FIT.** Regular shop methods, skills and tools speed fabrication.
- **PLEASANT TO HANDLE.** Workmen like the texture of Microtex.



keeps them efficient, too

both effectively... and at low cost

Thanks to carefully engineered metal air duct systems lined with Johns-Manville Microtex, it's quiet as a country churchyard inside many a modern building. Duct noises from motors, fans and adjacent rooms get into this fiber glass insulation—and never come out again! They're trapped and killed by countless microscopic air pockets formed by the millions of fine glass fibers.

Comfort is increased, too, because temperatures of the cooled or heated air can be more evenly controlled during distribution. This is a result of the high insulating efficiency of Microtex which also reduces power and fuel costs.

Johns-Manville Microtex is a semi-rigid blanket. The fine glass fibers are reinforced with textile yarn and bonded with a thermosetting resin. A black vinyl coating resists erosion even at top air velocities . . . eliminates need for painting inside of ducts in back of grills. Furthermore, with the insulation inside the duct, the sheet metal itself serves as the vapor barrier.

Over-all, Microtex provides maximum insulation value for dollar invested. It reduces installation costs—*see opposite page.* Its inorganic glass fibers are ageless . . . no danger of loss from rot, decay, moisture or vermin.

For specification and installation data on high-efficiency, low-cost Microtex, contact your nearby Johns-Manville representative. Or write to Johns-Manville, Box 14, N. Y. 16, N. Y. In Canada, Port Credit, Ont.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

The MARSH way is the SURE way—

You'll have a new conception of how *uniformly good* radiator valves, traps and vents can perform when you make the job Marsh all the way through.

Take the Radiator Valve and Trap illustrated here, for instance:

The Marsh Radiator Valve is *truly* packless—not just *called* packless. This valve has no "packing" whatever... instead, the ingenious Marsh annular mechanical seal that keeps it drip tight throughout its far longer life.

And Marsh Radiator Traps are equally sure-footed... have the famous Marsh Diaphragm—extremely rugged, but so sensitive that it never fails to close tight on steam, yet opens instantly to pass condensate and air at only a few degrees below closing temperature.

Yes, the Marsh way is the sure way...Valves, Traps, Vents, F & T Traps, designed, built and tested to give lasting satisfaction in the Marsh tradition. Ask for up-to-date Heating Specialties Catalog 76-H.

MARSH HEATING EQUIPMENT COMPANY

Division of Colorado Oil and Gas Corporation

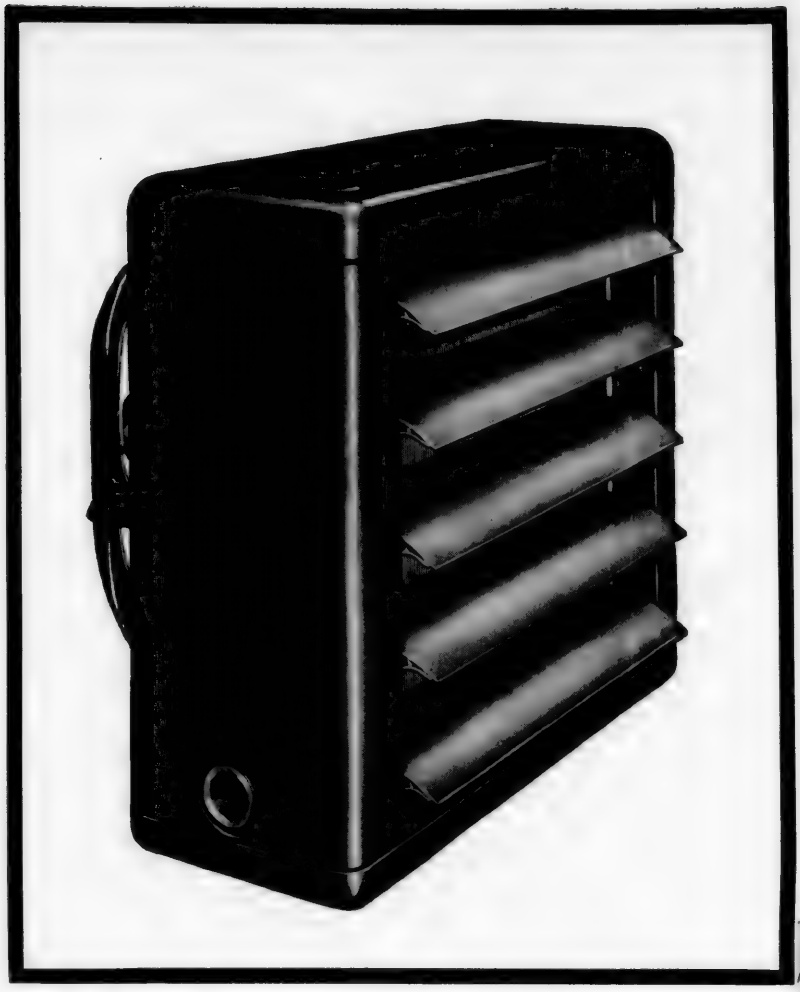
Dept. u, Skokie, Illinois

Marsh Instrument & Valve Co., (Canada) Ltd.

8407 103rd St., Edmonton, Alberta, Canada

MARSH *Heating Specialties*

SINCE 1865



Easy to Install!

Leak-Proof!

Economical!

Maintenance-Free!

Highly Efficient!

Ideal for High-Pressure "Spot-Heating" Installations!

"BUFFALO" BREEZO-FIN UNIT HEATERS

"Buffalo" Breezo-Fin Unit Heaters are your "best buy" for "spot-heating" applications in plants and commercial buildings. Flexible, economical and dependable, they are delivering peak performance in thousands of installations throughout the world.

Best of all, *leakage inside the unit is positively eliminated.* A one-piece, seamless copper tube extends from inlet to outlet ground joint. This provides absolutely leak-tight operation for steam pressures up to 250 pounds and 406°F. Special coils for higher pressures and temperatures can be furnished, on application, utilizing steam or hot water.

Other Breezo-Fin features include high-efficiency fans for quiet operation — streamlined, handsome appearance — fins designed for maximum radiation — sturdy construction for long, maintenance-free life — adjustable louvers to "spot" the heat exactly where it's needed. Available in 31 standard sizes from 16,000 to 497,000 BTU. Special larger packages also available for higher heating loads.

Be sure to investigate "Buffalo" Breezo-Fin Unit Heaters for *your* next "spot-heating" job. Contact your nearby "Buffalo" engineering representative, or write us direct for Bulletin 3137-E.

One of many "Buffalo" Breezo-Fin Unit Heaters installed in world's largest surgical dressings plant, equipped with special coils operating on 425°F hot water with 400 P.S.I. working pressure.

"Buffalo" products bring you the "Q" Factor—the built-in QUALITY that provides trouble-free satisfaction and long life.

"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Buffalo Pumps Division • Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

FROM COAST TO COAST...

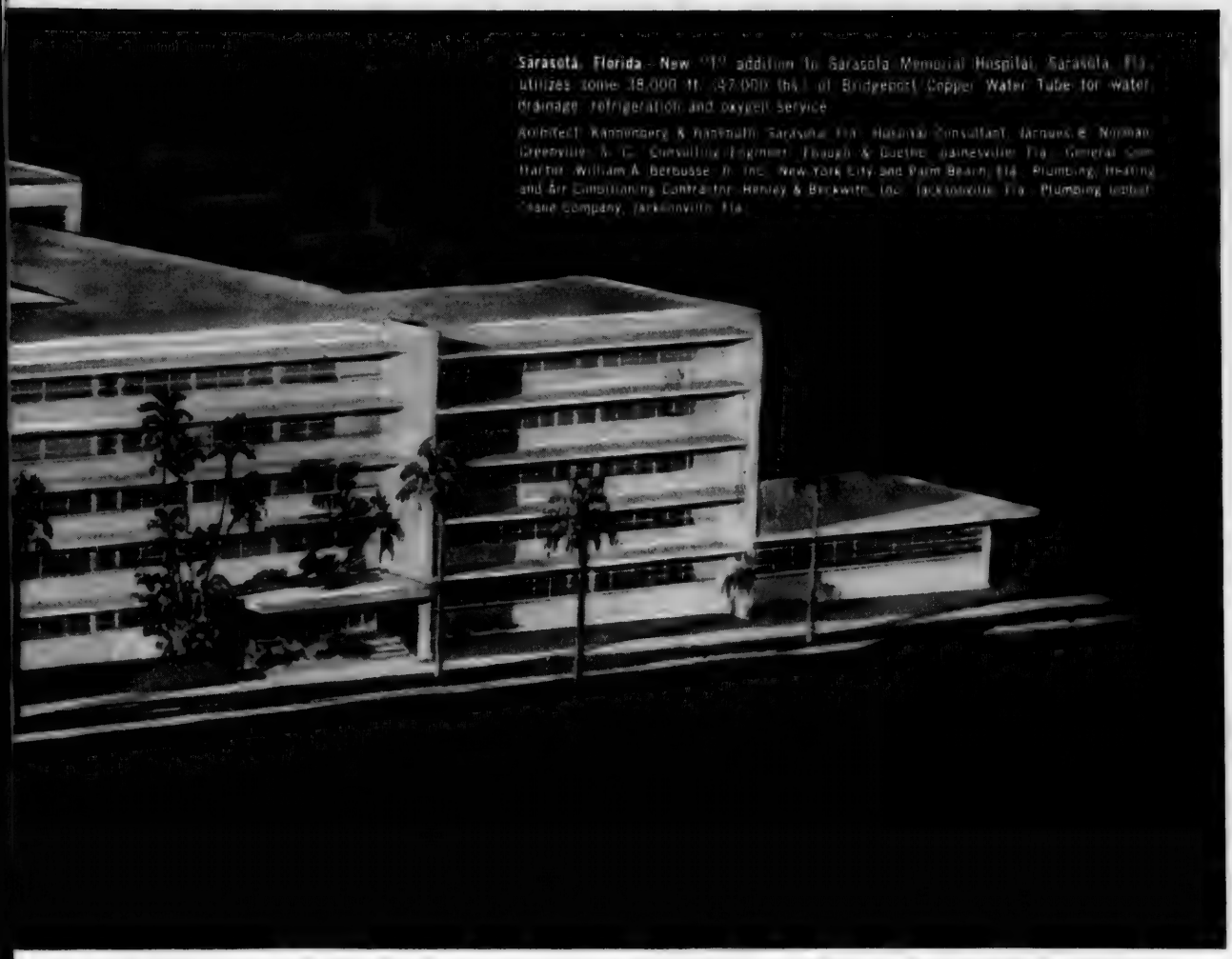
MORE HOSPITALS ARE BUILDING FOR KEEPS WITH LONG-

Pittsburgh, Pa.—No switching to Bridgeport needed during the major renovation at Western Pennsylvania Hospital, Pittsburgh, Pa. Contractors found existing piping to be Bridgeport's Plumrite installed when the hospital was originally built in 1908... still in very good shape 51 years later. So far, another 50,000 lbs. of Bridgeport Copper Tube have been installed for water and drainage lines, together with some 3-4,000 ft. for the hospital's oxygen lines.

Architect: Alfred D. Reid Associates, Pittsburgh, Pa.; Consulting Engineer: J. A. Murray, Pittsburgh, Pa.; Plumbing Contractor: George H. Soffel Company, Pittsburgh, Pa.; Plumbing Supplier: Amstam Supply Division, American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Burlingame, Calif.—Over 40,000 ft. of Bridgeport Copper Water Tube are used in the new Peninsula Hospital, Burlingame, Calif.

Architect: Stone, Marraccini & Patterson, San Francisco, Calif.; Mechanical Engineer: Buonaccorsi & Murray, San Francisco, Calif.; General Contractor: Williams & Burrows, Inc., Belmont, Calif.; Mechanical Contractor: Harry Lee Plumbing and Heating, Burlingame, Calif.; Jobber: Steam & Plumbing Service Corp., San Francisco, Calif.



Sarasota, Florida - New "D" addition to Sarasota Memorial Hospital, Sarasota, Fla., utilizes some 38,000 ft. (47,000 lbs.) of Bridgeport Copper Water Tube for water, drainage, refrigeration and oxygen service.

Architect: Kannenberg & Rasmussen, Sarasota, Fla. Hospital Consultant: Jarnes E. Norman, Greenville, S. C. Consulting Engineer: Clough & Dueitt, Gainesville, Fla. General Contractor: William A. Berbusse, Jr. Inc., New York City and Palm Beach, Fla. Plumbing, Heating and Air Conditioning Contractor: Hensley & Beckwith, Inc., Jacksonville, Fla. Plumbing Jobber: Crane Company, Jacksonville, Fla.

LASTING, DEPENDABLE BRIDGEPORT COPPER WATER TUBE

Cincinnati, Ohio—Scarlet Oaks Building of Bethesda Rest Home, part of the Bethesda Hospital in Cincinnati, Ohio, incorporates some 10,440 ft. of Bridgeport Copper Water Tube.

Architect: Sam Hannaford & Sons; Consulting Engineers: Wm. E. Bodenstein and W. W. Shuster; Plumbing Contractor: Wm. Teepe, Inc.; Jobber: Crane Company; all of Cincinnati, Ohio.

Hospitals demand the best in plumbing, heating and refrigeration tube as well as copper tube for oxygen systems direct to the patient's bed. Hospitals can't take chances with unproved or maintenance-prone products. That's why so many depend on long-lasting, **trouble-free** Bridgeport Copper Water Tube. Bridgeport Copper Tube is the finest available, yet offers outstanding budget advantages in easier and faster handling and lower installation costs.

Your plumbing wholesaler carries a full line of Bridgeport Color-Coded Copper water, drainage and refrigeration tube. Ask for it by name.

BRASS Bridgeport CO.

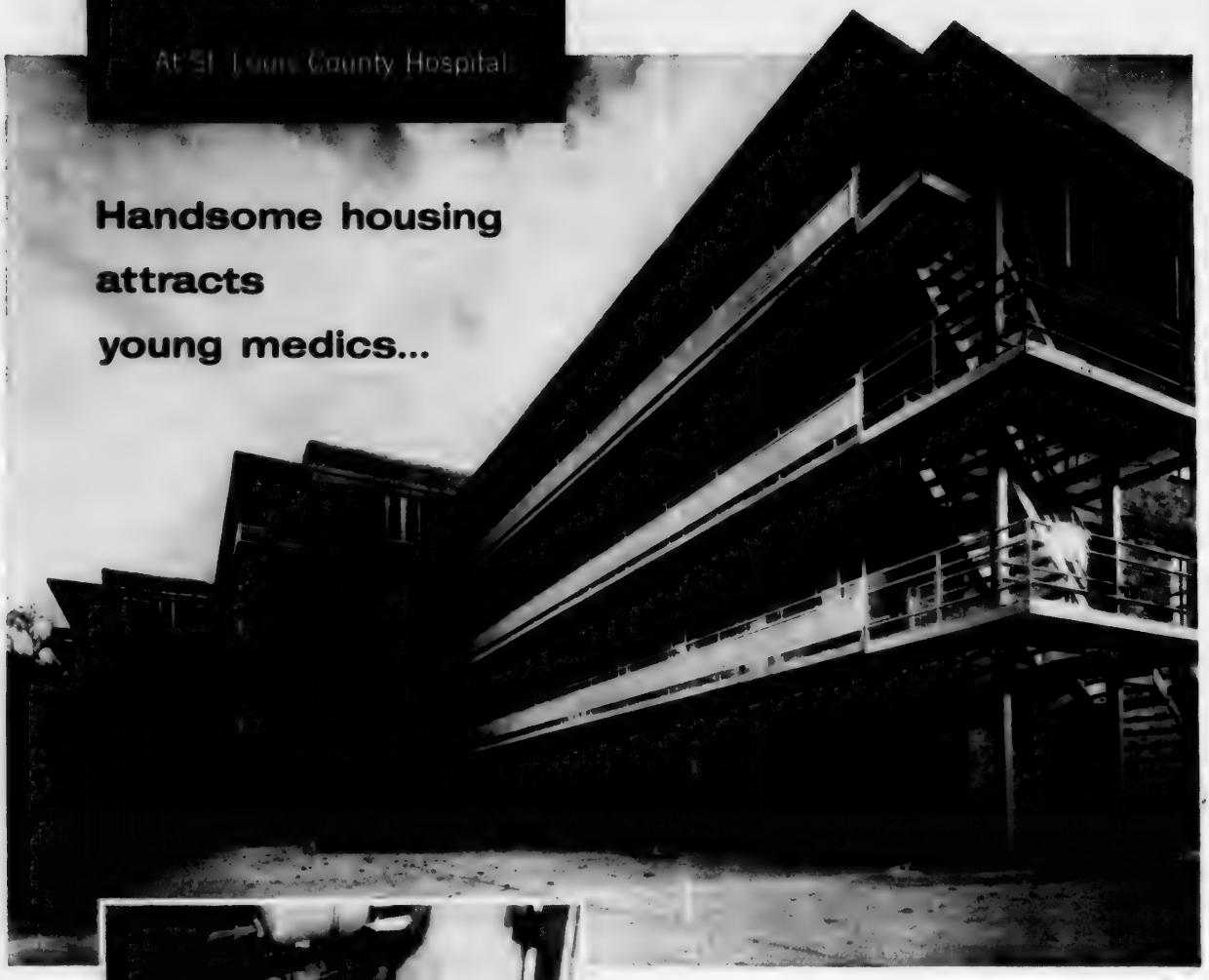
BRIDGEPORT BRASS COMPANY

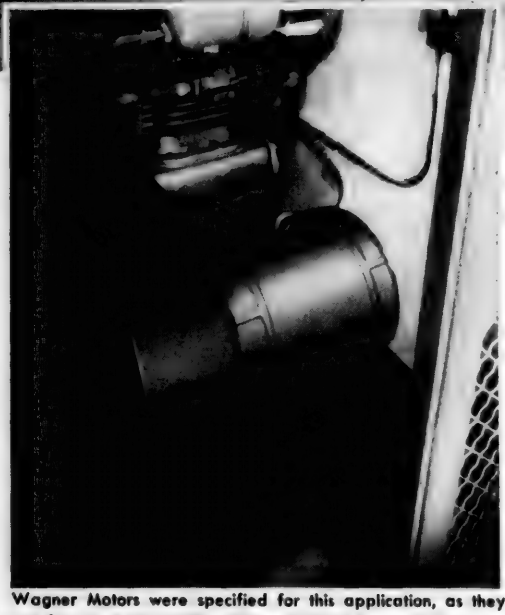
Bridgeport 2, Connecticut • Sales Offices in Principal Cities

Specialists in Metals from Aluminum to Zirconium

At St. Louis County Hospital

Handsome housing attracts young medics...





Wagner Motors were specified for this application, as they are for many air conditioning installations, because they give smooth, dependable power.

Designed to attract a larger number of medical school graduates to the St. Louis County Hospital intern program, this striking 18 family apartment building offers comfortable rent-free housing to interns, resident physicians and their families.

This new structure is actually three buildings, each with a central air conditioning unit. The compressors are driven by Wagner polyphase motors. These power-packed motors start compressor loads smoothly and easily, are small in size, light in weight—easier to install and maintain.

Whatever your motor requirements may be, Wagner can supply you a standard motor or build a special motor to fit your need. Constant research and development have kept Wagner up front in electric motor design for more than 65 years—made the name Wagner one you can trust in choosing motors for your plant or for your product. Call your nearby Wagner field engineer for an engineering analysis of your next motor application. There are Wagner branches in 32 principal cities.

WH59-3

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6463 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

LIVE BETTER ELECTRICALLY

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL* . . . *AUTOMOTIVE*

BEFORE YOU BUY, THINK:

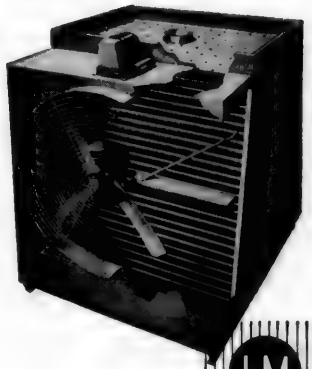
Will fungus attack your cooling tower 2 years from now?

Not if it's a Halstead & Mitchell cooling tower with a 20-Year Guarantee

The specially treated wood decking in H&M towers resists rotting, fungus attack and algae which accumulates and obstructs air flow in most other towers. Performance remains "like new" in H&M cooling towers year after year.

Only Halstead & Mitchell offers a 20-Year Guarantee on the wetted deck against failure due to rotting or fungus attack.

Other H&M features for unusually low maintenance include permanently sealed fan bearings, and a heavy gauge steel cabinet protected against corrosion by three plastic coats applied *after assembly*. Be sure. Ask your local wholesaler for H & M towers, or write to Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.



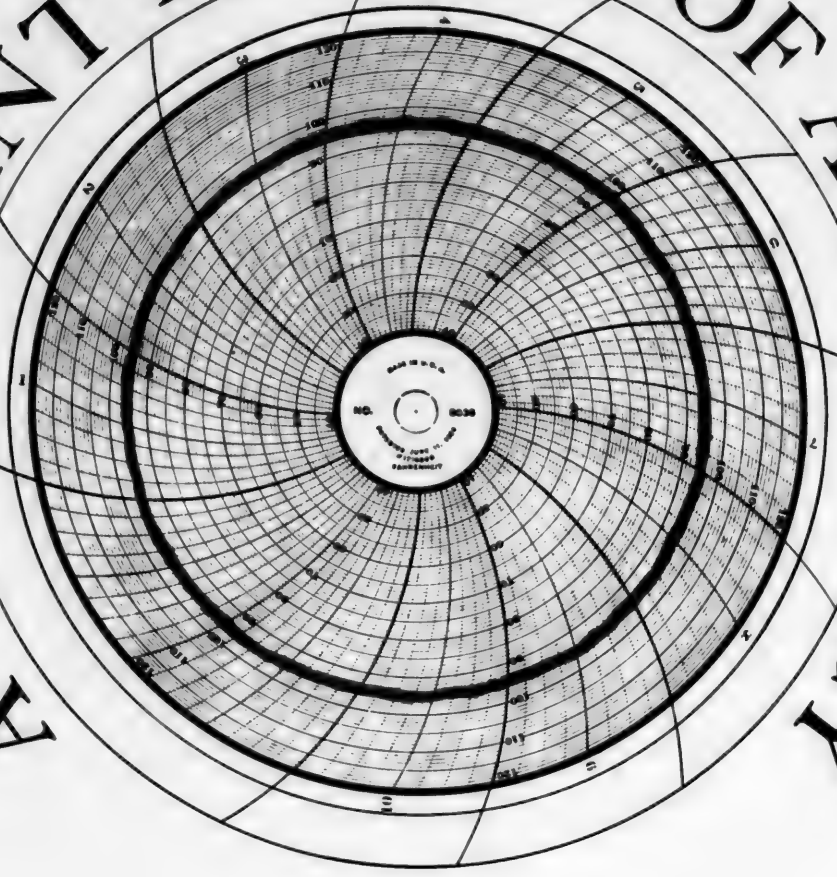
H & M COOLING TOWER WITH PRESSURE TREATED DECKING

HM

Halstead & Mitchell

Water-Cooled Condensers · Cooling Towers · Air-Cooled Condensers · Finned Coil Products

A CONSTANT RECORD OF ACCURACY



ON LAWLER TYPE "S" TEMPERATURE REGULATORS! LOOK AT THE TEST! LAWLER PINPOINTS CONSTANT THERMOSTATIC CONTROL!

DIRECT ACTING—protects against overheating . . . a rise in temperature closes the valve.

REVERSE ACTING — for cooling systems and recirculating lines. Rising temperature opens valve . . . drop in temperature causes valve to close.

THREE WAY—mixes hot and cold liquids.

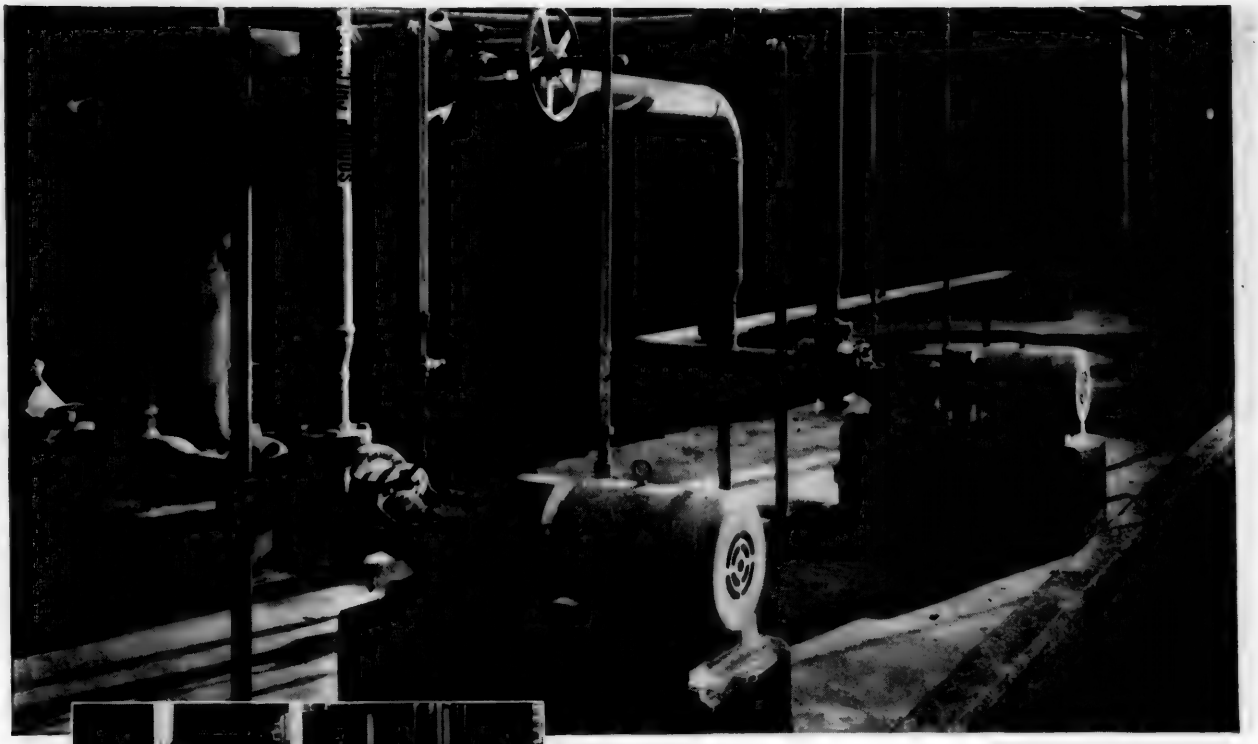
Wherever highly accurate thermostatic control is vital, you'll find Lawler Type "S" Temperature Regulators at work.

Advanced engineering design . . . skillful manufacturing have been Lawler's trademark for the greater part of a half century of solving thermostatic control problems.

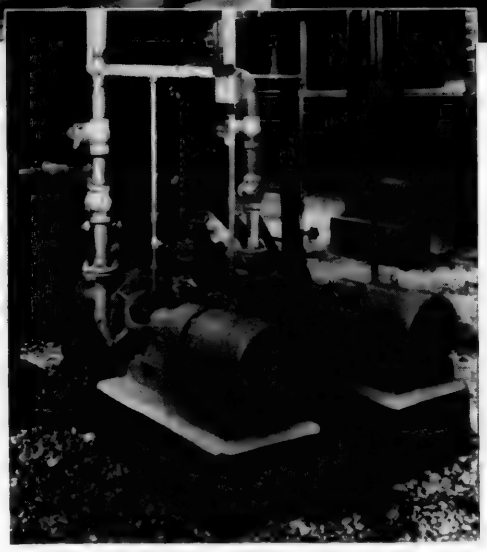
The Type "S" features a highly sensitive liquid filled thermostatic element for instant activation . . . stainless steel sliding parts for long-lived friction resistant operation.

WHEN PRECISION PERFORMANCE COUNTS LOOK TO LAWLER FIRST!

LAWLER AUTOMATIC CONTROLS, INC.
MT. VERNON NEW YORK



Above — "Buffalo" Single Suction Full Ball Bearing Pumps, stainless steel construction, handling sodium chlorate.



CORROSION— CONTAMINATION CONTROLLED WITH "BUFFALO" PUMPS

At left — "Buffalo" Single Suction Pumps of stainless steel construction handling hydrogen peroxide bleach.

Using a wide range of materials of construction, "Buffalo" offers a line of pumps capable of handling your toughest liquid moving job. You can order a "Buffalo" pump made of Hastelloy B or C, nickel, bronze, lead, stainless, in fact just about any material that can be cast and machined.

Properly applied, these pumps can cut your liquid moving costs, reduce down-time due to pump failure and improve quality control where contamination may be a factor.

For your tough liquid moving jobs, phone or write your "Buffalo" Engineering Representative or write direct. Tell us the liquid you want to pump and we will be pleased to suggest the best material of construction for the job.

"Buffalo" PUMPS

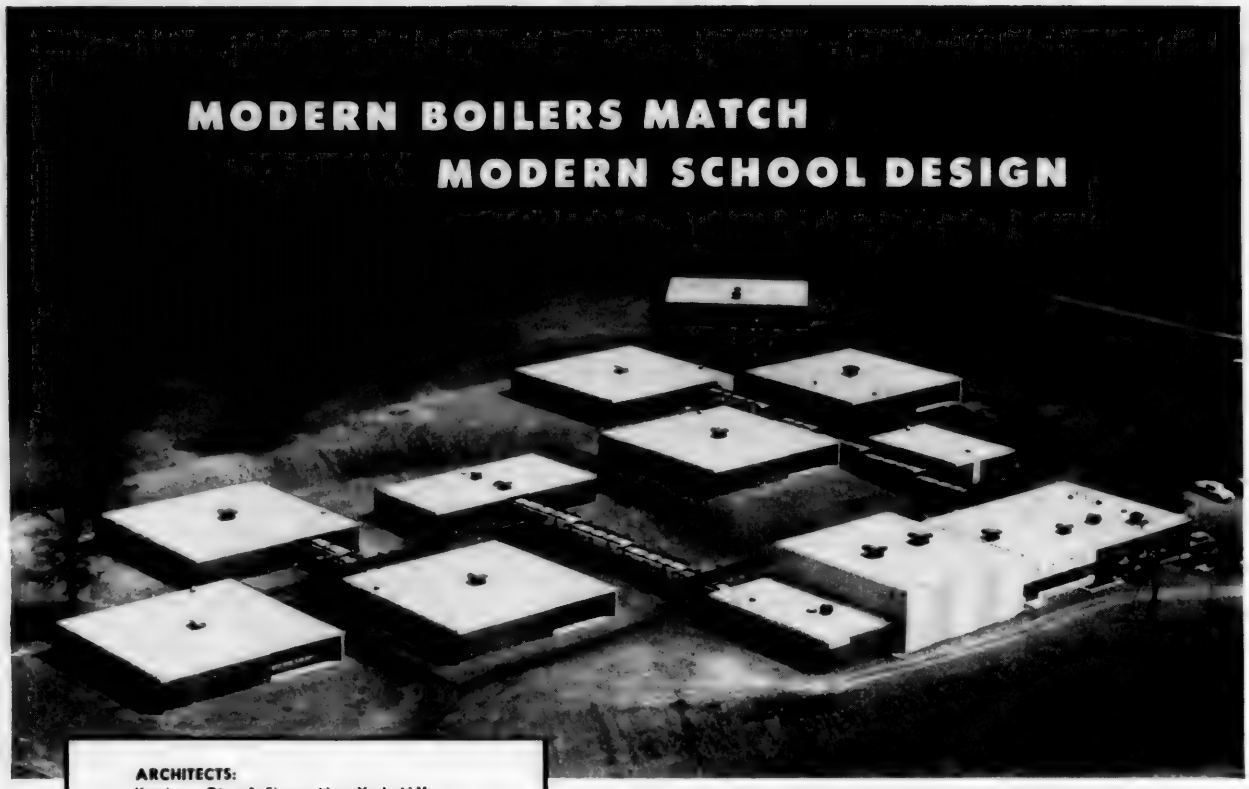
BUFFALO PUMPS DIVISION OF BUFFALO FORGE CO.

480 Broadway Buffalo, N.Y.

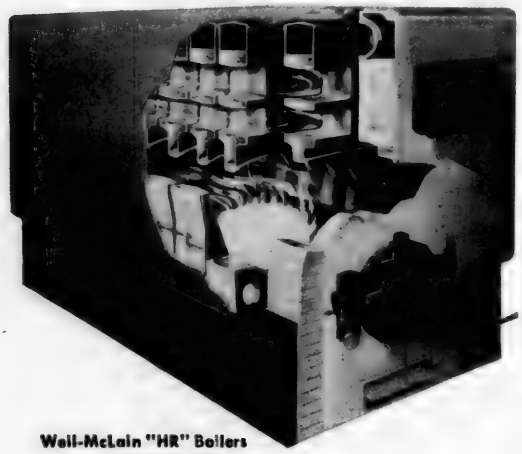
Canada Pumps Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

MODERN BOILERS MATCH MODERN SCHOOL DESIGN



ARCHITECTS:
Ketchum, Gina & Sharp, New York, N.Y.
ENGINEERS:
Cosentino Associates, New York, N.Y.
GENERAL CONTRACTOR:
Bregman Construction Co., New York, N.Y.
PLUMBING & HEATING CONTRACTOR:
The Frank Sullivan Co., Boston, Mass.
DISTRIBUTOR:
Joseph H. Young Co., Malden, Mass.



Weil-McLain "HR" Boilers are available with Certified Ratings of 885,000—2,942,500 BTU/hr.

This unit type school at Wallingford, Conn., typifies the new trend in school design and is matched in modernity by its heating plant.

The ten buildings are heated with two Weil-McLain HR44-12 Boilers, developing 162 HP. The boilers supply a forced hot water system circulating through underground piping.

Weil-McLain "HR" Boilers are cast iron sectional units, with all the advantages inherent in this type of construction. They are designed specifically to develop the economies possible with horizontal rotary oil burners using low-cost heavy oils. The large firebox creates better combustion conditions and maximum radiant heat transmission... complete combustion chamber data is available for each size boiler and type of burner. Balanced flue gas travel assures equal distribution of heat to all secondary heating surfaces. Generous waterways permit rapid, efficient water circulation.

Correct installation of the burner is made easy by a special steel front plate and the high base eliminates need for a high brick foundation.

Send for Bulletin C-188. For other Weil-McLain Gas and Oil Boilers, see Engineers' Product File or Sweet's Architectural File.

WEIL-McLAIN "HR"

HEAVY DUTY BOILERS FOR HORIZONTAL ROTARY OIL BURNERS

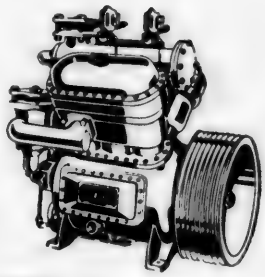
WEIL-McLAIN BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

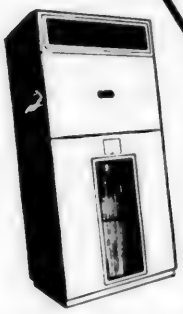
Address literature requests to Dept. BB-119

DON'T OVERLOOK THIS COST SHEET!

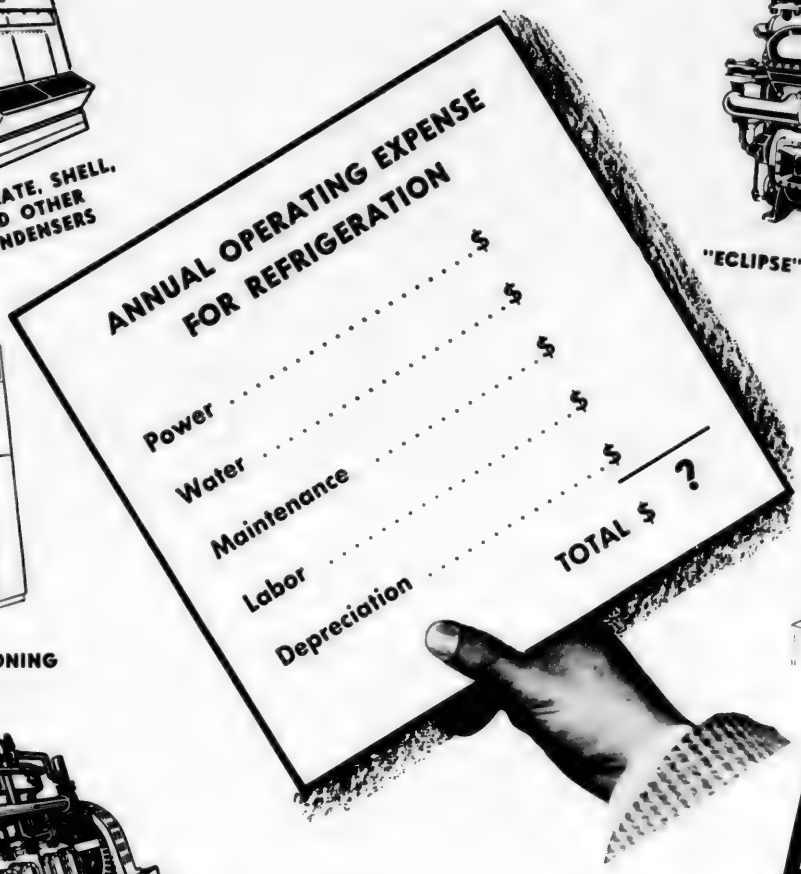
EVAPORATE, SHELL, AND OTHER CONDENSERS

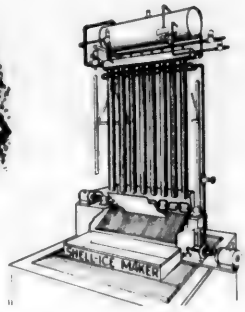


"ECLIPSE" COMPRESSORS

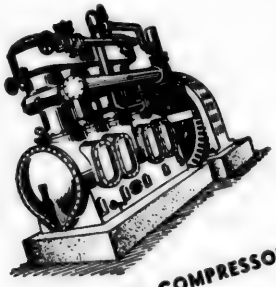


AIR CONDITIONING SYSTEMS





ICE-MAKING SYSTEMS



HEAVY-DUTY COMPRESSORS

ALL TYPES OF COOLING COILS

YOU CAN REDUCE MANY OF THESE COSTS!

BY HAVING THE REFRIGERATION SYSTEM DESIGNED TO MEET YOUR SPECIFIC REQUIREMENTS and by buying the entire system of equipment from a manufacturer with a background of experience and reputation in this highly specialized field.

Frick Company has been designing, manufacturing, and installing commercial and industrial refrigeration systems since 1882.

Whatever type you need—cold storage, ice making, air conditioning, quick freezing, very low temperature, or process cooling — Frick engineers will design a system to serve you with dependability and economy.

Let **FRICK ENGINEERS Provide a Frick System for You Today.....**

OFFICES AND DISTRIBUTORS WORLD-WIDE

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

Beth-Co-Weld serves Seattle University's William Pigott Building • Architect: John W. Maloney • Consulting Engineers: Bouillon, Griffith & Christofferson • General Contractors: Cawdrey and Vemo, Inc. • Mechanical Contractor: The Ballard Company • Pipe Jobber: Grinnell Company of the Pacific

In Seattle, Beth-Co-Weld Goes to College

And Excels on the Home Front, Too

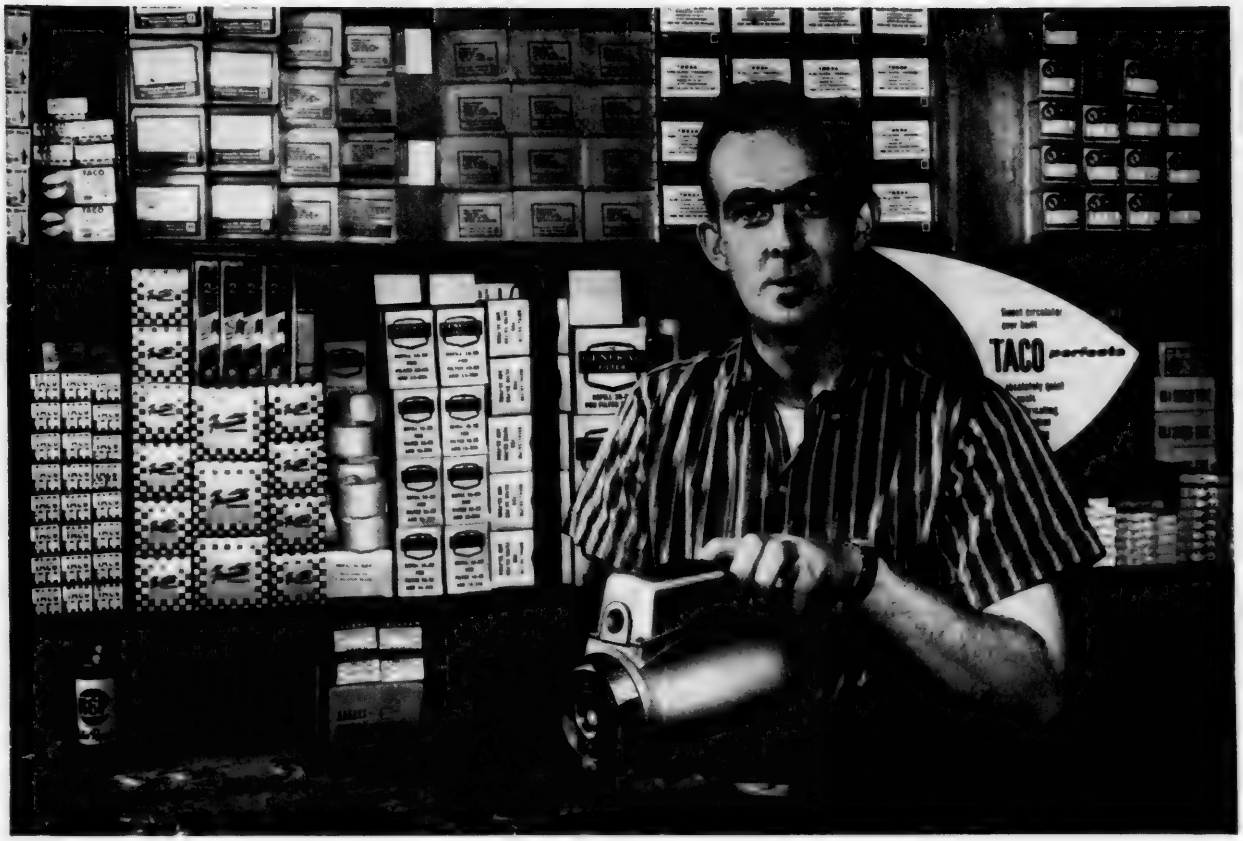
Steel pipe does the best possible job at the most reasonable cost. On your next project use Beth-Co-Weld—steel pipe at its best.

Seattle's Monticello apartments were built with Beth-Co-Weld in plumbing and heating lines • Architects: John O'Brien & Raymond H. Peck • Gen. Contr.: Hebb and Narodick Construction Co., Inc. • Mech. Contr.: The Ballard Company • Pipe Jobber: Grinnell Company of the Pacific

STEEL PIPE IS FIRST CHOICE
for lasting strength
economy
workability
insist on
STEEL PIPE MADE IN USA

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL



"New TACO *perfecta*® Eliminates Circulator Maintenance and Service Problems!"

"Install this new Taco Perfecta and forget it! Because of its simple, sealed unit design, there are no seals, drive couplings or starting switches to cause service problems. This water-lubricated pump is the most maintenance free, service free circulator ever built.

"See it in operation. You can't feel or hear it running. It circulates powerfully, smoothly, quietly without the drag and chatter of seals and drive couplings. No other pump could solve your circulator maintenance and service problems as effectively!"

See this modern streamlined circulator at your wholesaler today, or write TACO for complete illustrated literature.

The Perfecta outperforms, yet is smaller than conventional circulators. Uses less power, too!

TACO HEATERS INCORPORATED

Serving the Hydronic Industry Since 1920

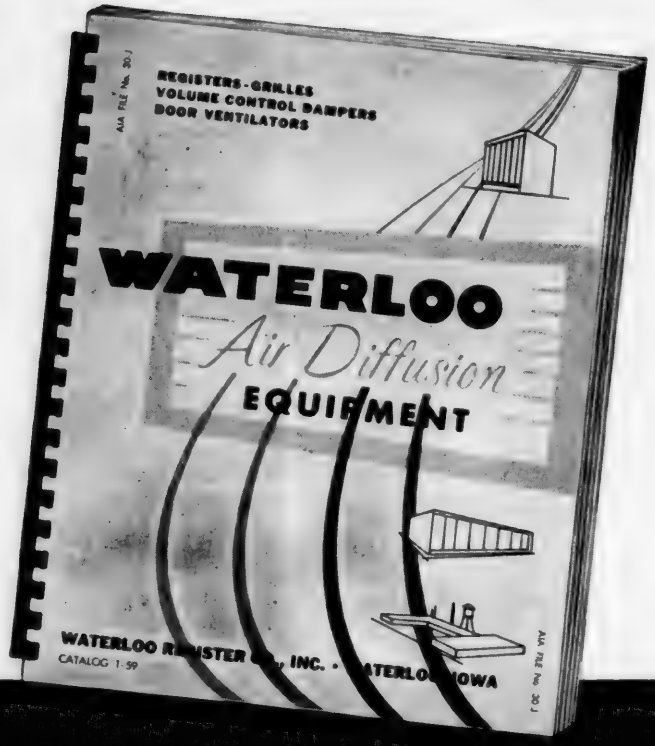
1160 CRANSTON STREET, CRANSTON 9, R. I.

Announcing

NEW WATERLOO Catalog*

- **Fully illustrated**
- **Color keyed for easy reference**
- **Contains complete data on wide range line of grilles and registers**

This new 58-page Catalog gives you information you need on Waterloo's complete line of return and supply registers, extruded aluminum Airline grilles, removable core grilles, volume control dampers and door ventilators. Each type of unit is well illustrated and keyed in color for quick reference. The catalog contains many recent design developments.

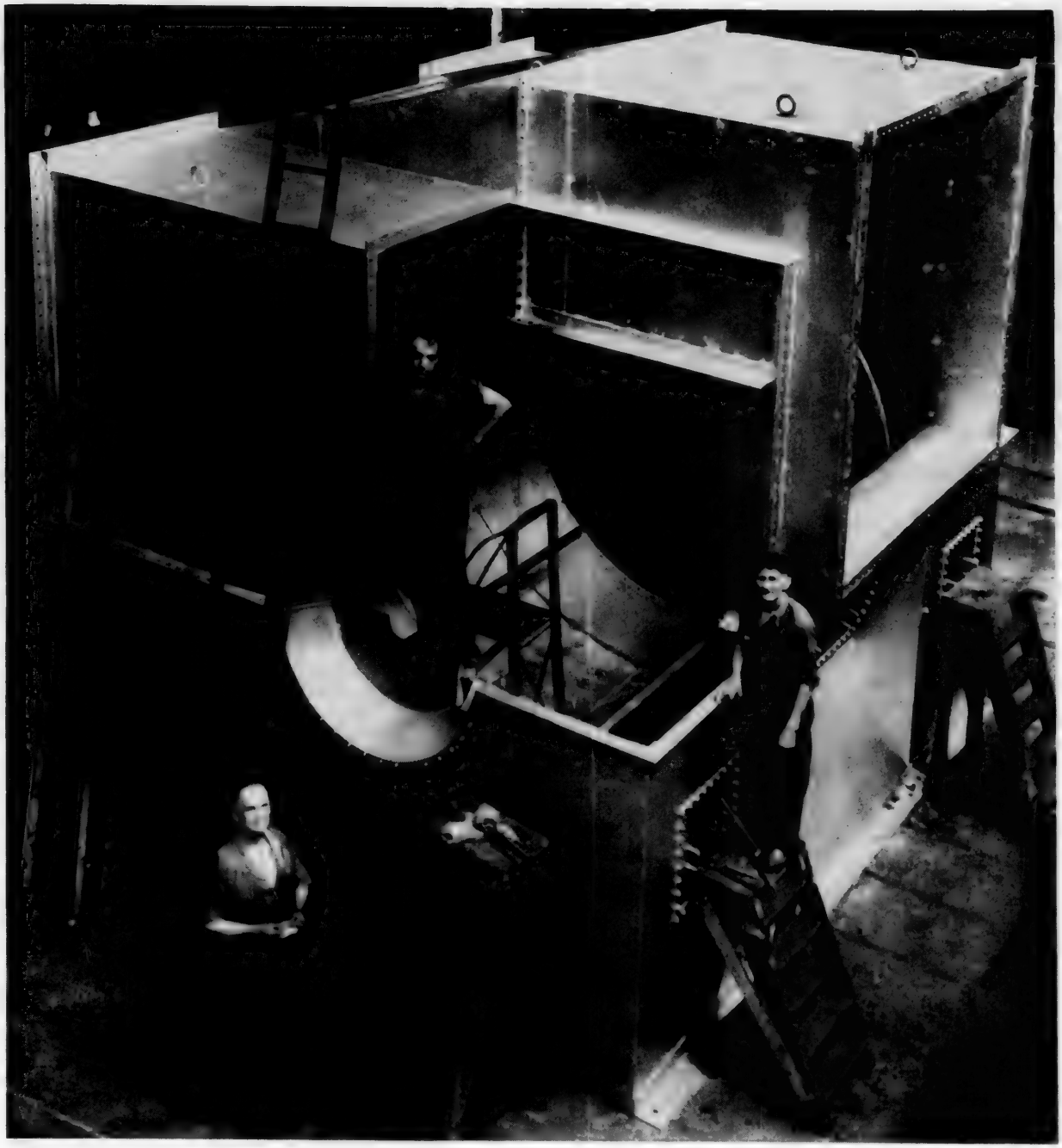


* *Write for your free copy of this comprehensive guide to the quality-built Waterloo line.*

WATERLOO REGISTER COMPANY, INC.
P.O. BOX 72, WATERLOO, IOWA

WATERLOO Air Diffusion EQUIPMENT

WR-113



You wouldn't buy a bargain basement parachute... or a cut-rate big game rifle...

Don't choose less than Clarage quality for your mechanical draft service. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Clarage, a specialist in building forced and induced draft fans, offers you equipment having a long-standing reputation for long-lasting service. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

Architect & Engineer: F. A. Fairbrother & Geo. H. Miehls • *Consultants:* Albert Kahn Associated Architects & Engineers
Mechanical Contractor: The Stanley Carter Co.

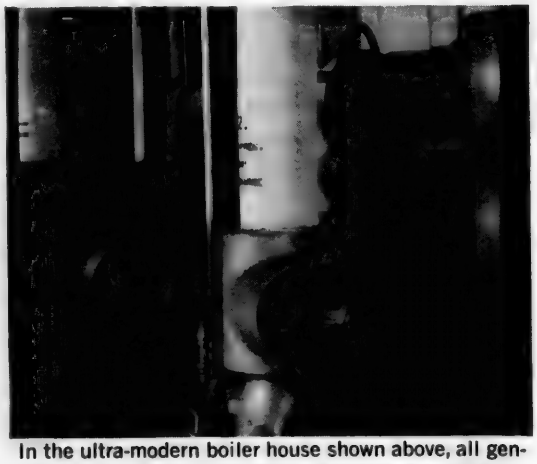
JENKINS VALVES assure reliable, economical control of Production's Lifelines

Cited as one of the nation's "Top Ten Plants of the Year", Chrysler Corporation's stamping plant at Twinsburg, Ohio, is a 34-acre model of building and manufacturing efficiency.

Go into the power plant and you will find Jenkins Valves everywhere, controlling "production's lifelines" that supply 150,000 pounds of steam per hour . . . 30 million cubic feet of air per day . . . 7500 gallons of cooling water per minute. Jenkins Valves got the job because "every effort was made to install the finest mechanical and electrical equipment . . . and to insure minimum costs by eliminating excessive upkeep and equipment with a short life span".

It is a highly significant fact that all building experts and operating engineers agree *"there's nothing better than Jenkins Valves"*. Many will always insist on JENKINS for critical services, and will prefer them for general use. After all, Jenkins Valves cost no more!

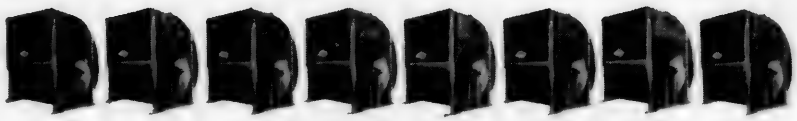
When you are buying or specifying valves, remember that the best valves are the best assurance of economical service. Jenkins Bros., 100 Park Ave., New York 17.



In the ultra-modern boiler house shown above, all general service valves controlling pipelines are JENKINS

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864 Jenkins Bros.

Sold Through Leading Distributors Everywhere



8 MASSACHUSETTS RETURN FANS

AND

7 MASSACHUSETTS GENERAL EXHAUST FANS

SERVE 575 LEXINGTON AVE. NEW YORK CITY

A typical Massachusetts installation! Eight very large power-fixed fans producing a total of more than 410,000 cfm. Wheel diameters ranging from 33" to 60". Seven general exhaust fans with wheel diameters ranging from 16½" to 44" producing a total of 63,000 cfm. We build BIG blowers for BIG installations. See your Massachusetts representative.

WRITE FOR CATALOG TODAY!

575 Lexington Ave.

Sam Minskoff & Sons, Owners and Builders

Cushman & Wakefield, Inc., Renting and Managing Agent

Sylvan Bien & Robert L. Bien, Architects

Sears & Kopf - John Anselmo Assoc., Consulting Engineers

Raisler Corp., Heating, Ventilating & Air Conditioning Contractor

PEERLESS ELECTRIC DIVISION
W. MARKET ST.

PORTER

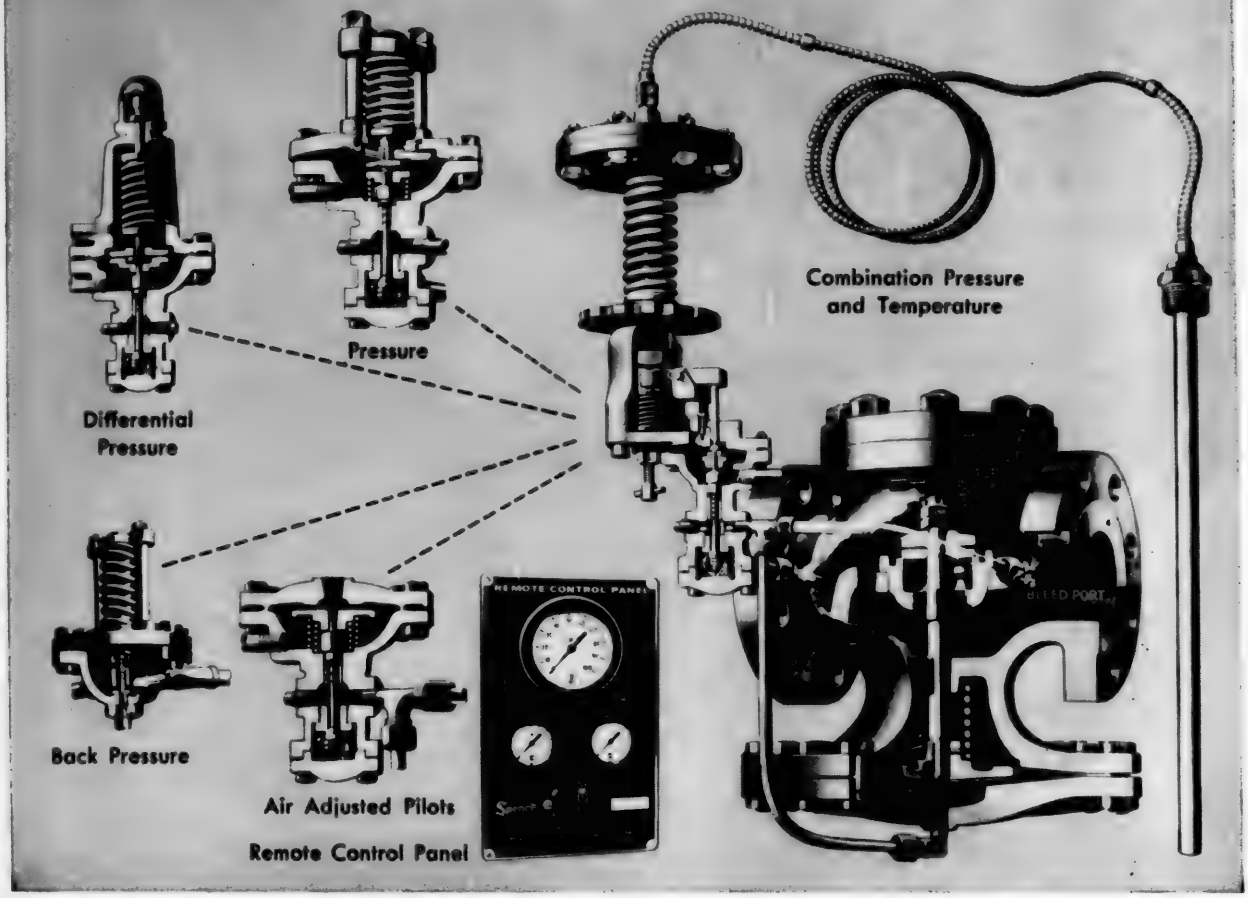
H. K. PORTER COMPANY, INC.
WARREN, OHIO

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION, PEERLESS ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A., and in Canada, Refractories, "Disston" Tools, "Federal" Wire and Cable, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

Member of the Air Moving and Conditioning Association, Inc.

VALVE TIPS:

All Pilots Fit All Main Valve Sizes Downtime, Maintenance, Inventory Reduced



Let's start off by admitting there's no such thing as a "maintenance-free" regulating valve. Any valve that automatically controls temperatures or pressures within close limits can be affected by dirt in steam lines.

If trouble does develop, engineers want a regulator they can get back on the line — fast. That's one reason why more engineers are standardizing on Spence Regulating Valves with externally mounted pilots. The simple test of disconnecting the external bends establishes whether the trouble is in the main valve or the pilot.

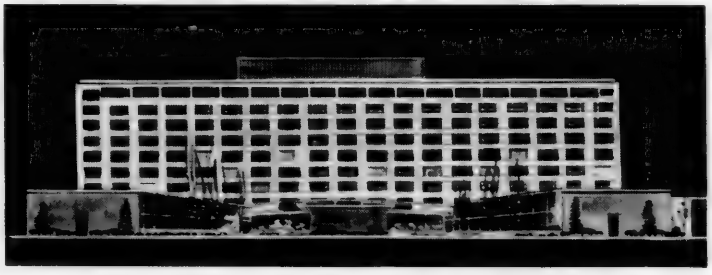
If the main valve is the trouble spot, it can be maintained without removing the valve body from the line. If the pilot is the trouble spot, it is easily removed for cleaning. However, if production downtime is a strong factor, the fastest method is to install a spare pilot and it is inexpensive.

All Spence pilots fit all sizes of Spence main valves. If you have twenty pressure regulators, for instance, all you need is *one spare pilot*. It will fit all main valve sizes from ¼" to 12".

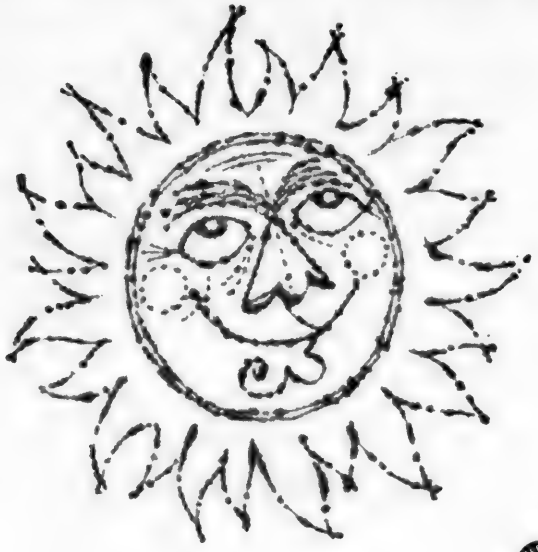
Another advantage of the Spence design is the external pilot is interchangeable. You can change the function of a regulator by merely changing the pilot. In many plants this can represent an important factor in reduced inventory costs because you only carry a few inexpensive extra pilots instead of complete regulators. Obviously, there is also a considerable savings in labor costs when a valve can be converted, in the line, from a temperature regulator to any one of various pressure regulators.

The pictures above show a few of Spence's wide line of automatic regulators. For more information write for Bulletin TE.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York SE-148



SHERATON-PORTLAND HOTEL, PORTLAND, ORE. Architect: Church, Newberry, Roehr & Schutte; Consulting Engineer: J. Donald Kroeker & Associates; Mechanical Contractor: J. M. Harder Plumbing & Heating Company.



Climate by Chrysler

Pumps out heat in summer, pumps in heat in winter . . . saves money all year for new Sheraton Hotel

The most complete heat pump system ever installed in a hotel is providing a money-saving answer to the problem of all-year air conditioning for the new Sheraton-Portland, in Portland, Oregon.

The system takes advantage of low local power rates and utilizes available well water. In summer, two 250-hp Chrysler Centrifugal Heat Pumps use the water to absorb heat from indoor air and keep the hotel cool. In winter, the cycle is reversed. Heat is extracted from the water and pumped into the hotel.

Individual Chrysler fan-coil units give occupants of each room complete control over indoor climate. Public spaces are served by Chrysler central air-handling units.

The Chrysler Heat Pump is versatile: It also supplies domestic hot water for the hotel's 300 rooms, and delivers, through boosters, near-boiling water for the kitchen. And the system is economical: It costs less to operate than conventional year-round air conditioning . . . and it even warms the swimming pool without added cost.

Whether your air conditioning requirements are best met by a heat pump or conventional air conditioning, Chrysler has the equipment and technical know-how to help you do the job better . . . for less. For information on the mechanics or economics of Chrysler equipment, write today.

CHRYSLER AIRTEMP

Airtemp Division, Chrysler Corporation, Dept. I-119, Dayton 1, Ohio
In Canada: Therm-O-Rite Products, Ltd., Toronto, Ontario

BOOTHS 335-339

THIS COUPON WILL LEAD TO PROFITS!

Forge & Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, New Jersey
Please send me full literature on your new *Fishmouth*

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... ZONE..... STATE.....

You've Got The Job! Here's How to Make It Profitable!

NEW W-S FISHMOUTH BRANCH FITTINGS

Typical Cost: Only 81¢ for 2 inch size for run pipe to 36 inches!

You bid for the job. Stayed late nights to get your bid low. Now the job is yours. But—where's the profit? You have to squeeze on materials and time to make it. Buy cheap—work fast. The old story.

But here's a new story. Figure your branch connections. Lots of them on every job. This new product, W-S FISHMOUTH—figure it instead of the usual tees, laterals, crosses. Savings are almost unbelievable. Makes the difference between breaking even and getting a profit.

If you send us the coupon, you'll learn more. We'll send a 16-page booklet. Tells the whole story. Shows costs for FISHMOUTH vs. other branch connections.

FORGE AND FITTINGS DIVISION PORTER **H.K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

FICTION
FACT

FICTION:

Removal of odors from the air requires bulky, expensive equipment—necessitating larger fans and motors to overcome resistance.

FACT:

R P Super Filter Coat applied to R P Aluminum Filters automatically removes both dust and odors with no other equipment required.

RP®

Multi-Velocity Industrial

AIR FILTERS

When you specify R P Industrial Filters, you gain the tremendous advantage of inexpensive, automatic odor-removal through the use of R P Super Filter Coat water soluble adhesive. Odors are actually removed from the air stream by absorption, held by the adhesive, and prevented from re-circulating. It is **NOT** a simple masking process—it's true, positive odor-removal. Through the reduction in make-up air requirements possible with this true odor removal, reductions in the size of heating and cooling equipment and in operating costs are available. And this important odor-removing function is, of course, a plus feature—in addition to effective dust removing properties and the like-new efficiency restored to the filter after washing and re-coating.

Permanent-type light weight, rugged, aluminum R P Industrial Filters have other advantages too. Their light weight makes them easier to handle and wash; eliminates heavy structural design in filter bank construction; reduces operating and maintenance costs through longer service life and easier handling. Write for complete information on the benefits of R P Industrial Air Filters.

RP *Products of Research*

RESEARCH PRODUCTS *Corporation*

Dept. 47, Madison 10, Wisconsin

Draftless Anemostat Air Diffusers at Sterling and Francine Clark Art Institute

The photograph above illustrates an Anemostat Straightline Air Diffuser installation in the gallery design of the Sterling and Francine Clark Art Institute at Williamstown, Mass. The conditioned air is supplied through Straightline Diffusers located on all four sides of the gallery. The diffusers not only draftlessly introduce conditioned air into the gallery, but also blend into the architectural design.

Anemostat, Round, Square and Straightline Diffusers for conventional or high velocity systems are adaptable to a wide variety of architectural designs.

Write for Selection Manual No. 60, which gives data on Anemostat's wide range line of air diffusion equipment.

ANEMOSTAT.®

DRAFTLESS *Aspirating* AIR DIFFUSERS

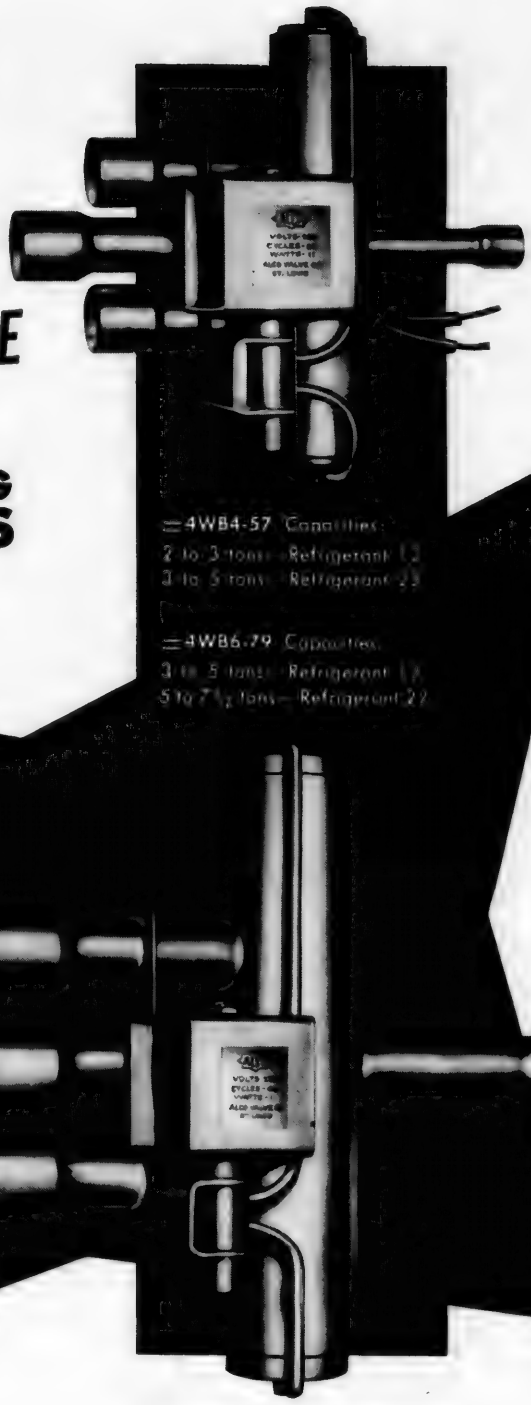
ANEMOSTAT CORPORATION OF AMERICA

10 East 39th Street, New York 16, N. Y.

Representatives in Principal Cities

AC-1359

Made by ALCO
OF CAST IRON AND STEEL
like a Compressor
for LONG RELIABLE LIFE



4-WAY REVERSING VALVES
for all reverse cycle systems

Features:

- fine machining and precision honing of cast iron slide and steel outer shell—NO PLASTICS ARE USED.
- operating tests of 300,000 cycles without failure to shift and without loss of tight seating—tests made by independent laboratories.
- shifting (change cycle) while the system is in operation with a 300 PSI differential.
- rapid shifting—to shorten change-over time and therefore shorten defrost cycle.
- the shifting of the valve independent of any pressure drops, and efficient shifting under any combination of operating conditions.
- mounting in any position—except with the pilot valve upside down.

=4WB4-57 Capacities:
2 to 3 tons—Refrigerant 12
3 to 5 tons—Refrigerant 22

=4WB6-79 Capacities:
3 to 5 tons—Refrigerant 12
5 to 7½ tons—Refrigerant 22

Call your Alco wholesaler—write for Specifications.

ALCO

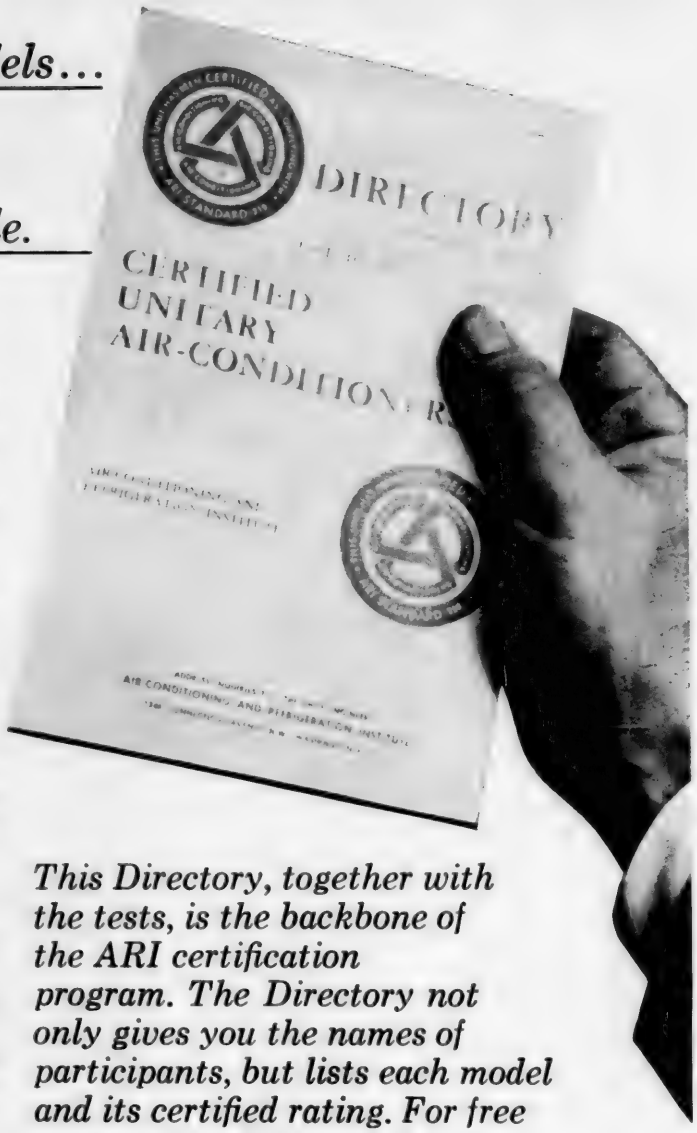
- *BUY SECURITY*
- *BUY QUALITY*
- *BUY ALCO*

8077

The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors Solenoid Valves • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves

WHO'S WHO IN UNITARY AIR-CONDITIONING*

Manufacturers...models... certified ratings. New listing now available.



This newest edition of the ARI Directory of Certified Unitary Air-Conditioners lists all participating manufacturers, their models, and certified ratings. It also explains this ARI program, which is specifically designed to help *you*. It provides standard rating capacity and dispels confusion for prospective customers.

The manufacturers (and their models) listed here are "blue bloods" of the industry. However, nothing is accepted merely on face value. Each model of certified unitary equipment must be of proven merit. Briefly, here's how the ARI Certification program works:

ONE: A test unit is selected *at random* from a distributor's stock. Comprehensive and closely-controlled tests are run on this unit for a total actual testing time of 22 hours. These tests determine whether the unit meets its advertised capacity—and other claims.

TWO: If, at any time during the testing, a unit breaks down or does not measure up to specifications, the manufacturer is immediately notified. He then has just 30 days, after final conclusions are reached, in which to revise his production procedures, or his rating, or otherwise bring his equipment up to specifications. If this is not done, the unit must be dropped from production immediately and it is rejected for inclusion in the ARI Seal of Certification program.

This Directory, together with the tests, is the backbone of the ARI certification program. The Directory not only gives you the names of participants, but lists each model and its certified rating. For free copies of the Directory for yourself or your customers, just write to: Chief Engineer, Department B,11 Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., NW, Washington 6, D. C.

*"Unitary" air-conditioners: all packaged air-conditioners, whether single units or combined units designed to be used together (called "split" systems), up to 135,000 btuh in capacity, but not including room air-conditioners or heat pumps

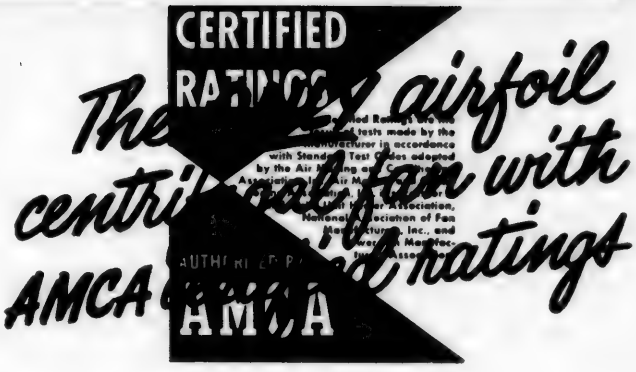
from pioneers...

to pacesetters

The pioneer of Airfoil Blading is the pacesetter again!

Now — Westinghouse Airfoil All-Purpose Centrifugal Fan performance data is AMCA certified!

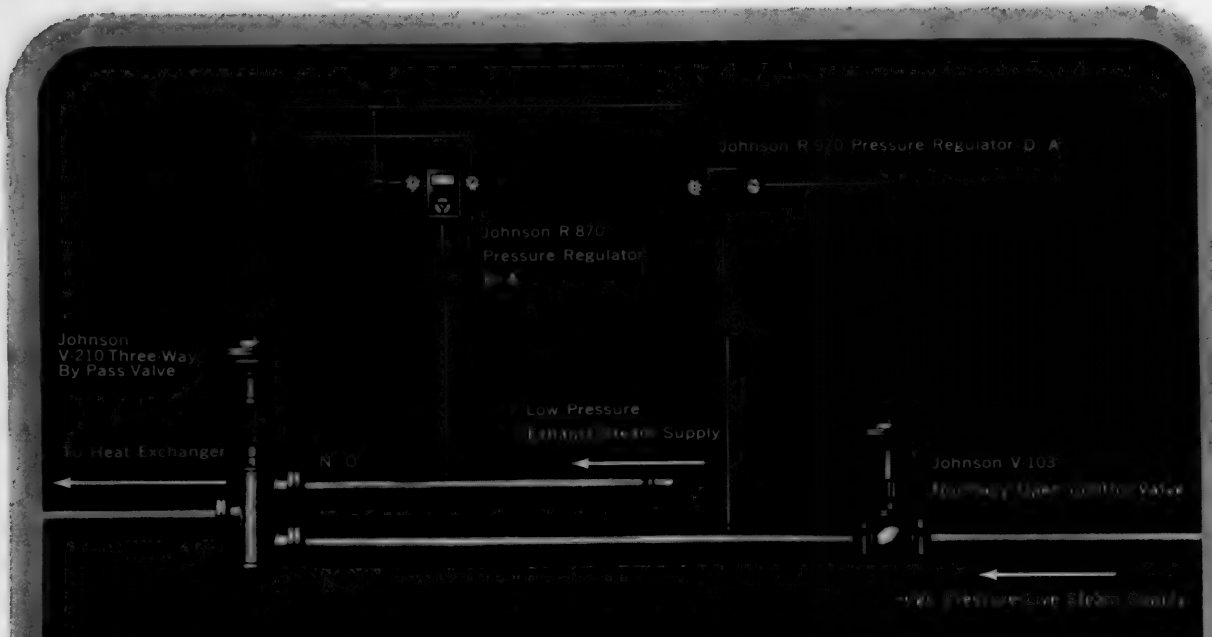
Take advantage of the only complete Airfoil Centrifugal Fan line with AMCA certification. Call your Sturtevant Division Sales Engineer or write for Catalog 1121 on Series 8000 Airfoil Fans to Westinghouse Electric Corporation, Hyde Park, Boston 36, Mass.



PLANTS AT HYDE PARK, MASS., LA SALLE, ILL., BERKELEY, CALIF.

YOU CAN BE SURE...IF IT'S Westinghouse

Watch "Westinghouse Lucille Ball-Desi Arnaz Shows" CBS-TV Fridays



USE EXHAUST STEAM— CUT YOUR COSTS

Johnson Control Hook-up Switches to Live Steam Only When Necessary

This simple control installation saves substantially on the consumption of live steam. And the savings are automatic!

Operation of the hook-up is positive and dependable. As exhaust steam pressure builds up to usable level, the Johnson Pressure Regulator activates the Three-Way Valve. The valve then shuts off the live steam and admits exhaust steam to the line. When exhaust pressure drops, the process is reversed.

Heart of the hook-up is the Johnson Three-Way By-Pass Valve. The 100% tight-closing design of this valve enables it to do the work of *two* ordinary valves. It can be piped straightaway for easier, less costly installation. Discs and seat rings can also be replaced with the valve in the line . . . for still further savings in maintenance.

Here is a method which can produce large economies for you by utilizing exhaust steam. Its effectiveness has been proved in scores of installations. For further information about the controls used, mail the coupon below.

JOHNSON SERVICE COMPANY
507 E. Michigan Street, Milwaukee 1, Wisconsin 989

Please send me your apparatus bulletins describing the following equipment: ☐ R-870 Pressure Regulator ☐ R-970 Pressure Regulator ☐ V-210 Three-Way By-Pass Valve ☐ V-103 Normally Open Steam Control Valve ☐ New Condensed Catalog of All Johnson Equipment ☐ Have a Johnson engineer call.

Name & Title.....

Company.....

Address.....

City..... Zone..... State.....

JOHNSON CONTROL
SINCE 1885

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

Now Available!

ULTRALITE® Duct Liner with special fire-resistant coating

For specification data and samples, call your G-B distributor (listed in the Yellow Pages) or write direct to:

New G-B Duct Liner conforms to strictest fire codes. ULTRALITE, Gustin-Bacon's well-known glass fiber duct liner with a 12-year record of outstanding performance, is now available at no extra cost with a gray fire-resistant coating that complies with all requirements of the National Board of Fire Underwriters' Bulletin No. 90-A and B.

The new product carries an Underwriters' Laboratories label and a flame spread classification of less than 25. It is the only liner permanently stamped with density and flame spread classification . . . the only liner made exclusively of long, strong textile-type glass fibers that impart extra strength, resilience and resistance to air erosion. Thermal and acoustical efficiency of this new gray-coated ULTRALITE, as compared with that of other duct lining materials, is outstanding. For complete information, call your nearby G-B distributor—or write today.

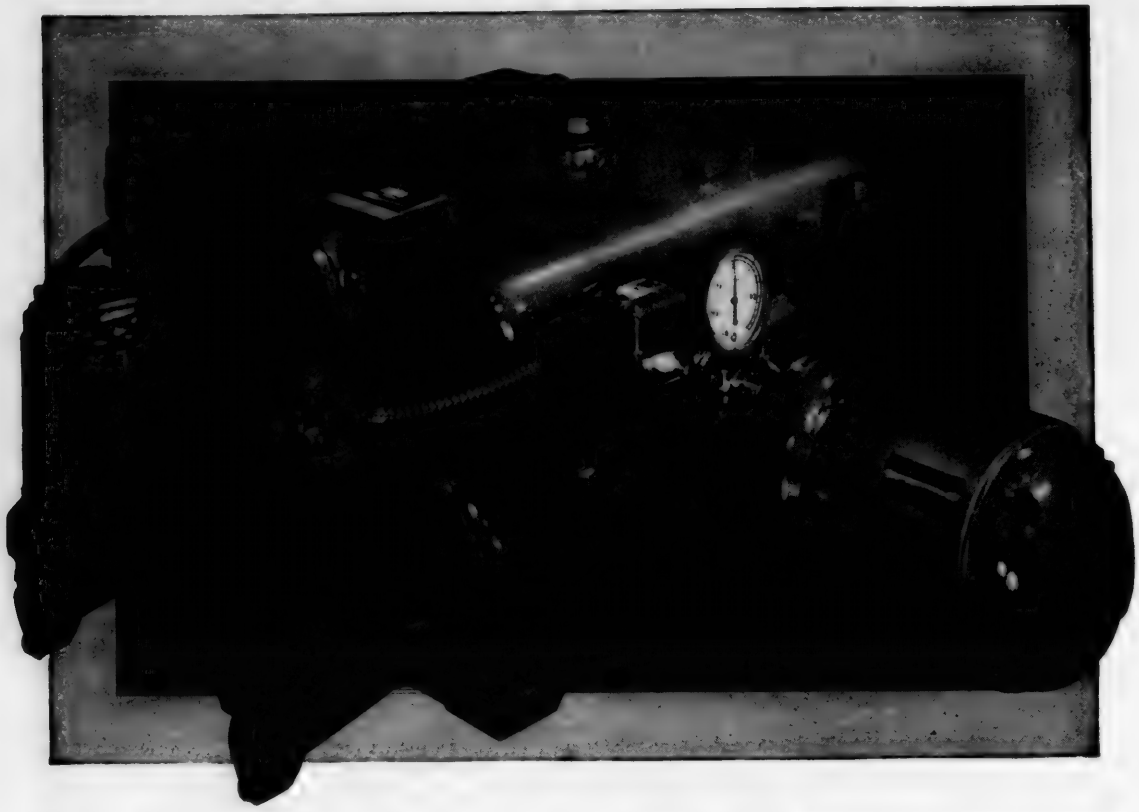
GUSTIN-BACON *Manufacturing Co* gb.

222 W. 10th St., Kansas City, Mo.

Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

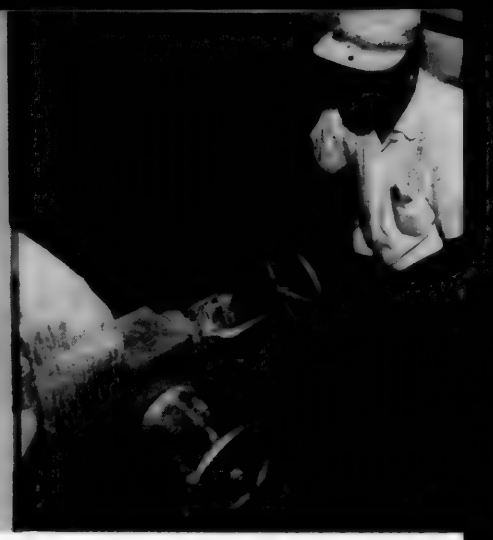
These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

Standards and Service Dictate Selection of

Boiler Blow-Off Valves



EDWARD E. FINSEL
Mechanical Engineer, Yarnall-Waring Co., Philadelphia, Pa.

Careful evaluation of auxiliaries by the designer beforehand may help prevent boiler outage due to failure of a relatively unimportant piece of equipment. Authoritative guides to the proper selection of these auxiliaries, then, are most welcome. Here is such a guide to the selection of boiler blow-off valves, with specification recommendations and installation and maintenance suggestions.

WHENEVER new boiler installations are designed it becomes expedient for the designer to have suitable data for selecting appropriate blow-off valves. In many instances the boiler manufacturer may have standardized on a given type of valve for each pressure-temperature condition. The appropriateness of this selection must be determined, howere, from many other aspects of the plant's use, and it is here that the plant designer can use discretion as to the requirements of his specific installation. Careful evaluation of auxiliaries by the designer beforehand may help prevent boiler outage due to failure of a relatively insignificant part after the equipment is in use.

Basis of Selection

The primary basis of selection of these valves is the ASME Power Boiler Code or a similar code which may take precedence. To properly apply blow-off valves, one should be familiar with the code requirement for this service.

Paragraph P. 310 of the ASME Power Boiler Code covers valve pressure ratings. Carbon steel fittings and valves designed to American Standards Association (ASA) requirements for 150, 300, 400, 600, 900, 1500 or 2500 psi are limited by the code under this paragraph in that they may be used for blow-off line service provided their adjusted pressure-temperature ratings exceed the maximum allowable working pressure of the boiler by 25% or 225 psi, whichever is less.

Edward E. Finsel, a native Philadelphian, graduated from Drexel Institute of Technology in 1944, as a mechanical engineer. He served in both the U. S. Army Air Corps and Signal Corps. After a four-year association with American Engineering Company, of Philadelphia, Pa., and a four-year period with the U. S. Navy Department in naval inspection, he became associated with Yarnall-Waring Company in its valve section. His duties there involved the design and application of valves principally in the power field. During his ten-year association with this company, he has advanced to Engineering Section Leader in charge of valves, which position he currently holds.

The Boiler Code Committee has set up a table listing the adjusted pressure ratings for saturated steam temperature conditions and the allowable values in blow-off service. This eliminates the need for calculations. See Table 1.

Cast iron blow-off valves are also permitted for boiler blow-off service. Their rating in this service is limited to 80% of the nominal ASA fitting rating. For instance, a 125 psi fitting is limited to 100 psi blow-off service, and a 250 psi fitting is limited to 200 psi blow-off service.

Brass or bronze screwed or flanged type valves may be used provided they are at least equal to the strength requirements of the American Standard cast-iron fittings which would otherwise be required. They should not be used where steel or other material is specifically required.

The code requires steel blow-off valves for boiler pressures over 200 psi. If boiler pressure is over 100 psi and iron blow-off valves are to be employed, they must be equal at least to the requirements of American Standards for 250 psi.

The code requires that, on boilers over 100 psi, each bottom blow-off pipe should have two slow opening valves or one slow opening and one quick opening valve. Both types are offered by manufacturers. Generally, more than one blow-off connection is required on a boiler, with two valves at each connection. These valves may be installed as separate valves or as a combination of two valves in a common body. See Figs. 1, 2 and 3. Where the two valves are bolted together, the assembly is known as a tandem and can be arranged in a variety of ways. Arrangement is based on space conditions around the boiler and has no relation to operating pressure or temperature. They should, however, be so installed as to

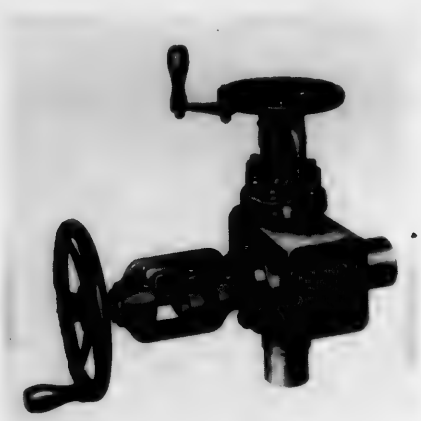


Fig. 1. (Left) Unit tandem valve combines both hard-seat and seatless valves in a common body for compactness.

Fig. 2. (Right) Quick-acting double-tightening valve next to boiler is bolted to an angle-type seatless valve.

permit good drainage and prevent trapping of blowdown in discharge lines.

Standard blow-off valves are made in sizes from 1 through 2½ inches. Remember, when selecting valve size, the larger the valve, the faster the removal of liquid from the boiler.

Valves in blow-off service may be provided with screwed, flanged or welded ends. The code does not allow the use of straight-run globe valves of the ordinary type for blow-off service since dams or pockets can exist for the collection of sediment.

To make valve selection more simple for the designer, most valve manufacturers have selection tables to guide users in the proper selection of blow-off valves. A typical manufacturer's table is shown in Table 2.

Blow-Off Valve Types

There are many different types of blow-off valves manufactured. These could be classified as follows:

1. Seatless, sliding-plunger type.
2. Sliding disc, or non-wedging gate type.
3. Seat and disc, or hard seat type.
4. Combination of two of the above valves (1 and 3) in a common body.

Materials

If service is standard, the metallurgy of the proposed valve will have been pre-selected by the valve designer for optimum performance under general blowdown conditions. If acid cleaning of the boiler is expected, valves with trim materials to withhstand the corrosive attack are available.

Blow-off valves are not affected by normal mechanical cleaning if reasonable care is taken. But in acid cleaning, acids are sometimes pumped into the boiler through blow-off valves at relatively high velocities to reduce the cleaning time. High flow rate tends to increase the corrosive action on valve during boiler filling. Acid discharge again subjects valves to this intensified erosive and corrosive action. Regardless of the size valve chosen, its walls should be heavy enough to withstand intensified corrosion during acid cleaning. Generally, thick wall valves are classed as heavy-duty type.

TABLE I—MAXIMUM BOILER PRESSURES FOR USE OF AMERICAN STANDARD STEEL PIPE FLANGES, FITTINGS AND VALVES

Primary Service Pressure Rating	Maximum Allowable Boiler Pressure, psig except as noted	
	Steam Service at Saturation Temperature	Boiler Feed and Blow-off Line Service
150	190	160
300	630	515
400	820	665
600	1160	970
900	1640	1450
1500	2500	2325
2500	3206 psia	3206 psia

Specifications

Accurately written specifications are the best guarantee that the valve manufacturer will furnish precisely what is wanted for the boiler. The surest way of tying down the valve you desire is by using its name and figure number as given in a manufacturer's catalog, plus the size and number of valves required. It is also advisable in every blow-off valve specification to add a phrase stating that valves are to conform to ASME Boiler Code, or other applicable code if there is one. Include in the specifications the maximum blow-off pressure the valves are to withstand.

Where valve name and figure number cannot be mentioned in specification, give a complete description of the valves and their trim material. If acid cleaning is contemplated, be sure to mention this in the specification for the valve. Since two valves are required for blow-off service, a specification is needed for each one. These specifications should be complete for each valve.

Installation

Before deciding which blow-off valve to use, it is wise to carefully check plant drawings and consider primarily ease of operation and space limitations. To guarantee proper use, valves should be so located as to enable an operator to readily accomplish his regularly scheduled task of blowdown. To ignore the human element is to invite trouble. Generally speaking, it is wise to locate the valves out in the open where they are easily accessible. With this is mind, the advantages of the unit tandem type of valve, having both valves in a common body, become quite evident. This eliminates a gasket or welded

TABLE 2—TYPICAL MANUFACTURER'S TABLE FOR BLOW-OFF VALVE SELECTION

Basic Pressure Ratings, psi	Maximum Allowable Boiler Pressure, psi, When Used For Blow-Off Service—Modification of ASME Boiler Code, Par. P-299, 1956 Edition	Valve Connections	Tandem Combinations Available			
			Two Type B* Seatless	Two Type A* Seatless	Double Tightening with Type B* Seatless	Double Tightening with Type A* Seatless
250	200	Screwed, Iron Body		X		X
250	200	Flanged, Iron Body	X	X	X	X
300	320	Screwed, Steel Body		X		X
300	320	Flanged, Steel Body		X	X	X
300	415	Flanged, Steel Body	X			
400	415	Flanged, Steel Body	X			

* Type A valves have a single port in the sliding plunger which allows flow to enter from one side only and discharge through the tube. Type B valves are similar seatless types except in that the plunger tube has a port on both sides, thus tending to balance the inner flow before discharge through the tube. Type B valves are considered a better selection as pressures increase.

joint between valves, and provides a compact dual unit for each blow-off connection.

Quick Start-Up

Recent studies by utility engineers show that quick starts of large high-pressure boilers from the cold condition can be made with less strain in the boiler structure than when conventional 5 or 6 hour starts are made. Success of quick starting depends on using correct procedures. These, of course, must be based on the individual installation, and few generalizations can be made for all plants.

A number of tests show that at present it is usually necessary to use the boiler's manual blow-off valves during the period immediately following the first light-off of fires for the quick start. On the boilers tested by one utility, the continuous blowdown lines sometimes do not have sufficient capacity to keep water-level surge within desirable limits during the first few minutes after starting. However, when the manual valves are used in conjunction with the continuous blowdown system, drum water level is easily and accurately controlled.

It is interesting to note that in several plants today blowdown operations are guided by the water-level indication on a television tube in the control room. Studies show that drum-water level needs constant attention during quick starts.

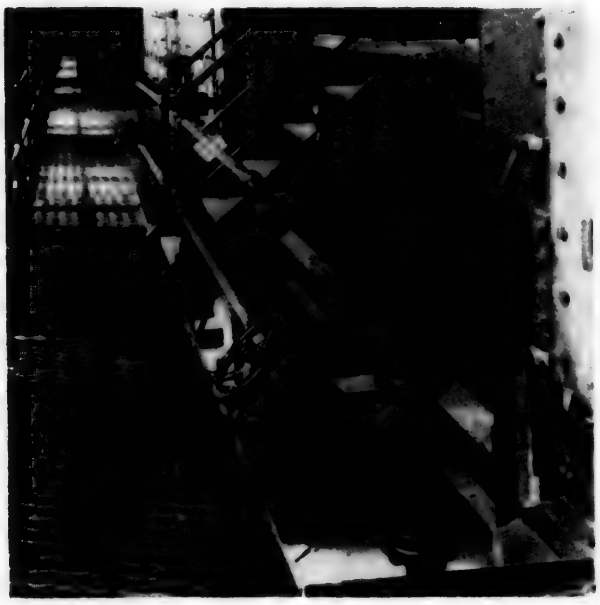


Fig. 3. Angle and straightway-type seatless blow-off valves bolted in tandem.

Maintenance

Materials used in modern blow-off valves tend to minimize maintenance. In general, packing is the only important item necessary to be kept in stock. New packing should be installed every time a valve is disassembled for any reason.

Due to the fact that blow-off valves operate a saturated steam temperatures, a high-temperature oil is recommended for maintenance lubrication. Good practice is to lubricate a valve just before it is operated, to guarantee lubricant in the proper place when it is most needed.

A relatively new development in the blow-off valve field has been the use of hard seat type valves with seats made integral with the body. By depositing the hard-facing material, usually stellite or its equivalent, directly in the body of the valve, the screwed-in seat connection is eliminated. Formerly valve seats were threaded in, and sometimes sealed by a gasket or seal welded. Now this is eliminated. Should the integral seat need attention, the manufacturer offers a tool which can recut or regrind the seating surface while the valve body remains in place in the pipe line. This is particularly useful when valves are welded in the line and not readily removable for servicing.

The foregoing material is naturally of a general nature and it is recommended that, since blow-off valves are somewhat different from other valves, procurement be made from a company that specializes in blow-off valve manufacture.

Application of Suction Line Superheaters

J. R. HARNISH
Engineer, York Division, Borg-Warner Corp., York, Pa.

Piping arrangements for a suction line superheater installed as part of a refrigeration circuit. This is the second article of a series.

A SUCTION line superheater is a means of transferring heat from high pressure liquid to suction gas in a refrigeration system. Reasons for engineers including it in the design of a system are:

1. To vaporize liquid carryover from the evaporator.
2. To provide a source of superheat to operate the thermal expansion valve on low temperature systems.
3. To subcool the liquid refrigerant.
4. To improve the thermodynamic cycle efficiency.
5. To meet conditions called for in a design specification.

As to the validity of these reasons, it is dependent upon the application of the heat exchanger and on the function it is to serve.

Refrigerant Liquid Carryover

It is often helpful as a precautionary measure to vaporize refrigerant liquid carryover from the evaporator. The carryover may result from a malfunctioning expansion valve, sudden changes in evaporator load, inadequate provision for returning oil at all load conditions, or because an expansion valve may be required to operate at a capacity condition below its stable operating region. Based on the normal practice for selecting the superheater, approximately 5% quality (per cent liquid by weight) can be vaporized in the heat exchanger.

Also contributing to its ability in a system to vaporize liquid carryover, is the flywheel effect of the heat in the mass of pipe between the superheater and the compressor. By this it is meant that with normal system operation, the suction line downstream from the superheater will remain at a temperature of approximately 25 to 30 deg F above the suction gas saturation temperature. With periodic liquid slugging from the evaporator, any liquid flowing beyond the suction line superheater will have additional heat added to it by the warmer suction line. In this respect, steel pipe will provide a little better than twice the amount of heat stored by copper lines.

Use of Superheater

On some installations, the superheater is desirable to provide a source of heat to actuate a thermal expansion valve. Certain design evaporators require complete flooding of the heat transfer surface; starving the evaporator to obtain the necessary heat may result in a severe penalty in cooling capacity. Consequently, the use of a suction line heat exchanger may permit complete flooding of the evaporator surface and provide greatest efficiency.

On low temperature installations, considerable superheat may be required to actuate the thermal expansion valve at low absolute refrigerant pressures. A given force is needed against the expansion valve diaphragm to open the valve port, and since large changes in refrigerant temperature are required for an increase in pressure, the amount of superheat required to open the expansion valve may be substantial. The superheater may be particularly helpful on a thermal expansion valve-fed, low temperature brine cooler, or air cooling coil where the medium cooled has a small temperature range, making little superheat available.

On some installations, the high pressure liquid line may contain a large number of restrictions, such as valves, fittings, a dehydrator, strainer, bullseye, and/or may be required to rise through a large change in elevation between the receiver and expansion valve. With the condensed liquid draining from the condenser at a temperature a few degrees below the condensing temperature, flash gas may result ahead of the expansion valve because of the liquid line restrictions and/or change in elevation. Flash gas entering the expansion valve will reduce the valve capacity and may cause sporadic operation at variable load conditions. The suction line heat exchanger provides a means to subcool the liquid while superheating the suction gas and will likely overcome any tendency to form flash gas in the liquid line.

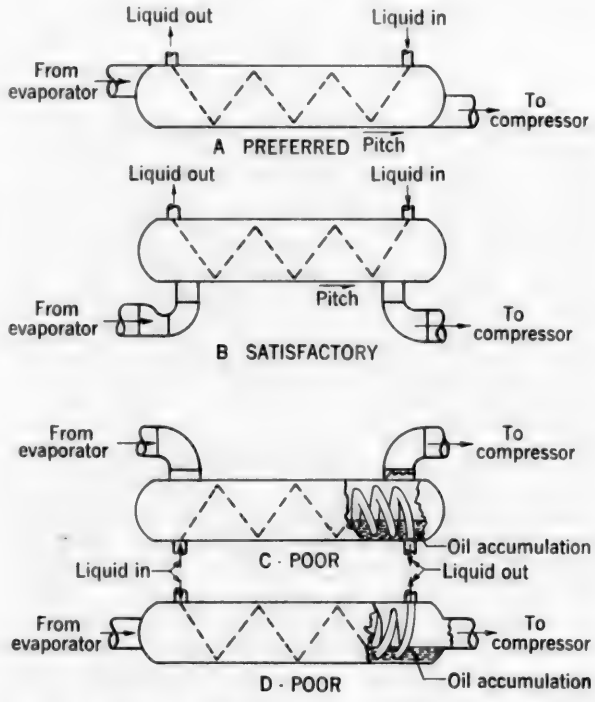


Fig. 1. Suction line superheater arrangements with respective grades.

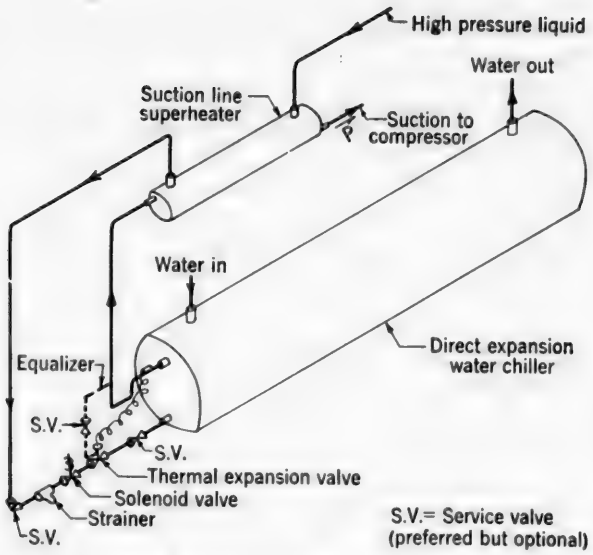


Fig. 2. Suction line heat exchanger with direct expansion water chiller.

On Refrigerant-12 systems, each degree of liquid subcooling requires approximately 1½ deg suction superheat. Approximately 2 deg superheat is required to provide a degree liquid subcooling on Refrigerant-22 systems.

As to the thermodynamic gain possible by using a suction line superheater, the improvement in system efficiency varies considerably from one installation to another and is a function of system design conditions and the design of the reciprocating compressor. The theoretical cycle efficiency is only improved at most a few per cent, since the increased availability of the subcool liquid refrigerant is nearly offset by the increase in specific volume of the superheated vapor flowing to the compressor. However, test results indicate that this gain is at times better than theoretical on small bore reciprocating compressors. Apparently this is brought about by the reduction in discharge gas reheat to the suction gas at high superheat conditions because of the greater loss to the ambient.

Many design specifications for air conditioning and refrigeration systems require that a superheater be provided. On many systems, its presence is justifiable. On others, it is merely an additional expense item which would be better eliminated. On many flooded evaporator systems, the superheater is an unnecessary expense. At times, too, it may work hardships on the system design because of the increased suction line pressure drop, reducing system capacity, plus the fact that many superheaters are poorly designed or misapplied.

Superheater Arrangements

Figure 1 illustrates several suction line superheater arrangements. Arrangement *A* is preferred as this design overcomes all the deficiencies of the others. Suction gas from the evaporator enters one end of the superheater shell near the top and the gas leaving connection to the compressor is located at the opposite end, tangentially to the bottom of the shell. The superheater, along with the interconnecting gas piping, is pitched toward the compressor and oil cannot collect in the shell. The high pressure liquid from the condenser enters the gas leaving side of the heat exchanger to provide the warmest liquid to the gas leaving the heat exchanger.

Arrangement *B* is satisfactory and will usually provide trouble-free operation, although it is not as desirable as arrangement *A*. The design of this heat exchanger requires that the suction gas enter and leave the shell perpendicular to its length. By locating both gas connections at the bottom of the shell, oil buildup in the superheater should not be a problem. However, the gas entering the heat exchanger is required to flow through a short vertical rise where oil return may be a problem at reduced compressor capacity. Consequently, it may be necessary to reduce the line size of the vertical pipe to maintain sufficiently high gas velocities to keep the oil in motion. In making this reduction in line size, an eccentric reducer should be used with the flat side on the bottom to avoid any liquid traps. Also, it is important that the horizontal suction line be pitched in the direction of flow.

A poor design is shown in arrangement *C* where the same design heat exchanger is incorporated as in arrangement *B*, but with the gas connections at the top of the shell. Low gas velocities through the heat exchanger are encountered and some oil flowing with the suction gas will collect in the superheater. The outcome will be a compressor running out of oil or possibly even worse, liquid slugging to the compressor upon changing load conditions or system startup after a shutdown period. The liquid flow here is in parallel with the gas flow, whereas counterflow would improve the heat exchanger performance.

Arrangement *D* illustrates another design which can lead to system operating difficulty. The gas connections are located on the horizontal centerline of the superheater shell with the shell diameter somewhat greater than the horizontal suction line. Depending upon the actual design, gas velocities again may be extremely low through the heat exchanger with considerable oil collecting in the trapped portion of the heat exchanger.

One of the most common uses of the suction line superheater is with the direct expansion water chiller as illustrated in Fig. 2. This diagram shows the preferred piping arrangement. High pressure liquid from the condenser or high pressure receiver, if used, enters the gas leaving end of the superheater and leaves at the opposite end. The subcooled liquid refrigerant flows through a service valve, strainer (at times a combination strainer-drier, solenoid valve, thermal expansion valve, and service valve before being introduced to the refrigerant side of the water chiller. The two service valves, provided to isolate the strainer, solenoid valve, and thermal expansion valve, are optional and left off many systems to reduce costs. However, in the long run, their use is usually justified for the value in servicing the equipment without pumping down the entire low side, the latter leading to contamination of the system with non-condensables and moisture.

An external gas equalizer is shown connected to the thermal expansion valve and this is generally preferred to give more stable operation of the expansion valve. Note that if service valves are provided in the liquid line, it is also prudent to include one in the small, usually ¼ inch O.D., gas equalizing line.

A small trap is provided in the suction line as it

leaves the evaporator before going into the vertical riser, and the expansion valve thermal bulb is located upstream of the trap. The trap provides a means of draining oil and liquid refrigerant away from the bulb location to avoid sporadic valve operation. For this type of system, the thermal bulb should always be located between the evaporator and the suction line superheater due to the opposing influence the superheater would otherwise have on the valve operation. The preferred water inlet connection is at the gas leaving end of the evaporator to provide maximum gas superheat.

The liquid line solenoid valve provides positive shutoff of the liquid feed when the system is idle. The solenoid valve is frequently wired in series with the water temperature thermostat or controller, with the compressor operation controlled by a low pressure cutout. In this way, the evaporator is kept pumped down during the off cycle so the compressor will not start with an evaporator filled with liquid. Either "continuous pumpdown" or the "one-shot pumpdown" cycle may be used.

Brine Cooling

For low temperature brine cooling, particularly where large quantities of brine are cooled through a small temperature range, the suction line superheater may be necessary for satisfactory operation of a thermal expansion valve. This requires special treatment since the thermal bulb must be located downstream of the superheater. The preferred arrangement is illustrated in Fig. 3. High pressure liquid flows through a service valve, strainer, and solenoid valve before branching through two parallel circuits. At the full load condition, the larger quantity of liquid flows through the thermal expansion valve. A smaller portion flows in parallel through the liquid side of the superheater to a hand expansion valve where it joins with the main flow of liquid to enter the evaporator.

If all of the refrigerant liquid were to pass through the superheater, operation of the thermal expansion valve would become very sporadic. Each time the expansion valve closed, the liquid flow through the superheater would stop. If the valve overfeeds, little heat will be available in the superheater to dry the suction gas. Furthermore, before the valve can again open, the evaporator must become starved to furnish the necessary superheat since little heat will be available from the cooled liquid in the superheater. Cyclic operation of the thermal expansion valve would result with very poor control.

Continuous Flow Through Superheater

If the liquid flow through the superheater is continuous as illustrated in Fig. 3, a steady source of superheat will be available to the expansion valve and satisfactory operation can be achieved. Care should be exercised in throttling the hand expansion valve to prevent a flow rate greater than the minimum capacity condition expected on the system. For instance, if a low temperature system can be expected to unload to 50% capacity, it should be operated at this condition with the thermal expansion valve inoperative and the hand expansion valve throttled to slightly starve the evaporator. If this precaution is not taken, overfeeding of the evaporator may result at the minimum load condition, causing liquid carryover to the compressor. Note that the two branch liquid lines are downstream from the liquid line solenoid valve to provide positive shutoff of both circuits when the system is idle.

For low temperature systems required to operate at temperatures below approximately —50 deg, particularly Refrigerant-22 systems, oil becomes less fluid and more difficult to return. Also, suction line sizes must be based upon economic considerations regarding pressure drop as it will affect system capacity. Thus, the mass flow of refrigerant will be less than for the air conditioning range of temperatures and the oil return problem is further compounded.

Consequently, when possible, it is preferred that no vertical risers be provided in the suction line. Many times this is not possible, but care should be exercised to keep the length of vertical risers to a minimum.

In Fig. 3, gas leaving the evaporator flows horizontally to the superheater and the entire suction line and superheater network is pitched toward the compressor. A trap is provided beyond the thermal bulb location to drain oil away from this point.

The external gas equalizer should nearly always be provided on low temperature systems to minimize the amount of superheat required to operate the thermal expansion valve.

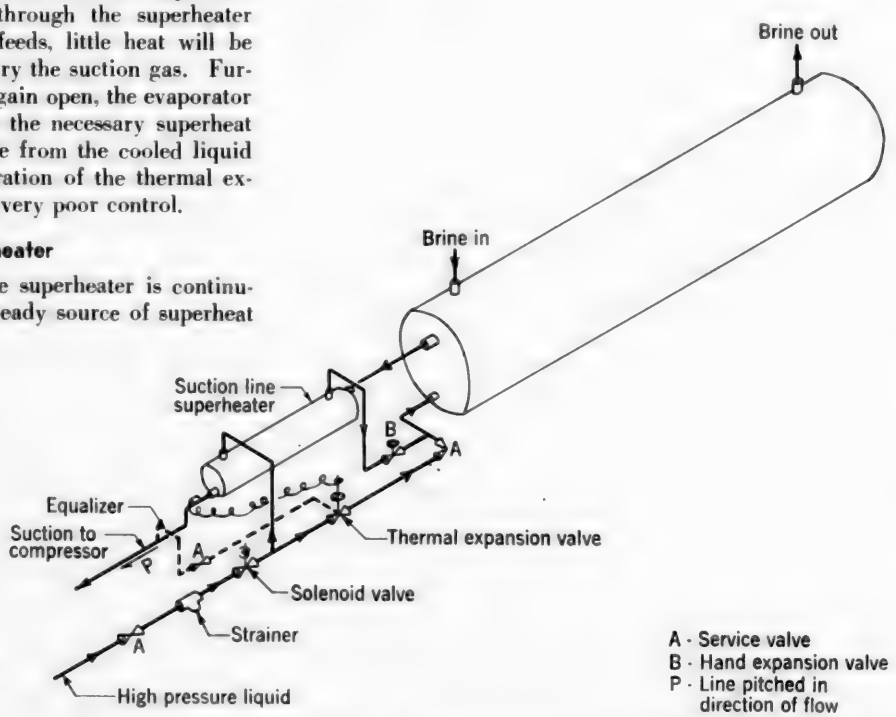


Fig. 3. Suction line heat exchanger with low temperature direct expansion brine cooler.

Save Computation Time With

Air Sensible Heat Change Factors

GORDON W. NEAL
Mechanical Engineer, Consoer, Townsend and Associates, Consulting Engineers

With these sensible heat change factors, all that is needed is the rate of air flow, initial temperature and final temperature to get air heat gain or loss directly.

HEATING, ventilating, and air conditioning designers, called upon to determine the amount of sensible heat gain or loss for a quantity of air when it is changed from one temperature to another, in most cases know the rate of air flow, the initial temperature, and the final temperature. A solution involving only these three factors would save considerable computation time, since most methods require either a transfer of flow from a volume to a weight basis or an adjustment based on the absolute temperature.

Oftentimes the flow and the temperature change are multiplied by the factor 1.08 to determine the heat added or lost. This has the disadvantage of applying only to cases where the flow is expressed in the equivalent volume at 70 deg F. When air flow is taken at some other temperature an adjustment is still required.

Tables 1 and 2 were prepared in order to provide factors for calculating sensible heat change over the range of temperatures ordinarily encountered in heating, ventilating, and air conditioning work. The factors do not apply, however, to changes involving cooling below the dew point. The errors that would result are of particular significance when the initial temperature is in the range covered by Table 2. Factors apply to the formula:

$$H = Q\Delta tF$$

where H = heat gain or loss, Btu per hr,
Q = air flow, cfm,
Δt = air temperature change, deg F, and
F = factor from Tables 1 or 2, corresponding to the temperature at which Q is taken.

TABLE 1—FACTORS FOR AIR TO 110 DEG F

Air Temperature, Deg F	Factor, Btuh per (Cfm) (Deg F)	Air Temperature, Deg F	Factor, Btuh per (Cfm) (Deg F)
—20	1.30	50	1.12
—10	1.27	60	1.10
0	1.24	70	1.08
10	1.22	80	1.06
20	1.19	90	1.05
30	1.17	100	1.03
40	1.15	110	1.01

Tabular values in Table 1 are based upon an average of dry air and saturated air. As air temperature rises, the moisture content plays an increasingly important part in the amount of sensible heat required to change the temperature. For the range of temperatures of Table 1 the maximum error in computed sensible heat, which could arise from moisture content variations, is less than 1%.

For the range of temperatures in Table 2, variations in moisture content may be considered significant, depending upon the precision required. Thus, sensible heat change factors for air in increments of 20% relative humidity are given. Linear interpolation will give values at smaller increments.

Example

Assume that it is desired to size a coil for heating 1000 cfm of 50 deg air to 100 deg. From Table 1, $F = 1.12$; therefore,

$$H = (1000)(100 - 50)(1.12) = 56{,}000 \text{ Btu per hr.}$$

On the other hand, if the 1000 cfm were the quantity of air desired at 100 deg, then $F = 1.03$; and

$$H = (1000)(100 - 50)(1.03) = 51{,}500 \text{ Btu per hr.}$$

TABLE 2—FACTORS FOR AIR FROM 110 to 210 DEG F

Air Temperature, Deg F	Percent Relative Humidity					
	0	20	40	60	80	100
	Factor, Btuh per (Cfm) (Deg F)					
110	1.005	1.008	1.011	1.014	1.017	1.020
120	0.988	0.992	0.996	1.000	1.004	1.009
130	0.971	0.977	0.983	0.988	0.994	0.999
140	0.955	0.962	0.970	0.978	0.986	0.994
150	0.941	0.951	0.961	0.971	0.981	0.991
160	0.926	0.939	0.952	0.965	0.979	0.992
170	0.911	0.929	0.946	0.964	0.982	0.999
180	0.898	0.920	0.943	0.966	0.988	1.011
190	0.884	0.913	0.943	0.972	1.002	1.031
200	0.871	0.909	0.948	0.986	1.024	1.062
210	0.859	0.908	0.956	1.005	1.053	1.102

When and Where
Is Make-Up Air Necessary?

G. M. HAMA
Bureau of Industrial Hygiene, Detroit Department of Health
Detroit, Michigan

Negative pressure inside a building may create adverse or dangerous conditions. Here's how to correct troubles.

IF make-up air is not provided to a tightly closed building which is under mechanical exhaust ventilation, a partial vacuum or negative pressure may develop within the building. Then, products of combustion from flues on hot water heaters, space heaters and furnaces may be drawn by back draft into the room and produce a serious carbon monoxide exposure. Negative pressure also may reduce air flow into local exhaust systems to the extent that they no longer control irritating or toxic contaminants. Other adverse effects of negative pressure are high velocity cold drafts through window cracks and door openings and pressure on doors which renders them hard to open and causes them to slam forcibly.

When Is Make-Up Air Necessary?

Obviously, when any of the above adverse conditions exist, make-up air is necessary. However, it is possible that small amounts of mechanical ventilation may not cause unsatisfactory conditions if there are sufficient openings for air to enter the building. When the area of make-up air openings is small relative to exhaust volume, adverse negative pressures develop within the building. When negative pressures attain the magnitude of the pressures shown in Table 1, make-up air is necessary. Table 1 shows conditions resulting from various degrees of negative pressure. These figures are approximations based on some field studies, an examination of fan rating tables and some theoretical calculations. They represent the more sensitive conditions (short flues, low stacks, low pressure fans, etc.) affected by negative pressures in the building.

Fig. 1. Inclined manometers measure pressure differences.

How Need Is Determined

Certain conditions brought about by negative pressures (doors difficult to open, back drafting oil or coal furnaces, etc.) are obvious and indicate the need of make-up air without resorting to special instrumentation.

Other adverse and sometimes dangerous conditions are more subtle and cannot be determined without tests or measurements. Reduced efficiency of local exhaust systems and general ventilation systems, and back drafting gas-fired appliances may result from lack of make-up air without management being aware of it until complaints of ill health or discomfort occur.

A rather simple measurement of negative pressure within the building will give a fair approximation of the need of make-up air. For this measurement an inclined manometer having a 1-inch w.g. scale range graduated to read in division down to .01 or .005 inch is used. (See Fig. 1.)

The measurement is made by leveling and zeroing the manometer at some central point within the building away from ventilating equipment, windows and doors. The positive pressure side of the manometer should be connected to a length of rubber tubing (preferably pressure tubing) sufficient to extend outdoors through a window crack or other small opening so that the tube opening is downward. If possible, for greater precision, and to offset the effect of wind pressure, measurements should be made through four sides of the building and averaged. Measurements should be made in winter weather, with all windows and doors shut tight and all heating and ventilating equipment turned on. It is preferable to make the measurement on a day free from high velocity winds.

The negative pressures can be compared with the pressures given in Table 1. If these pressures are exceeded, it is very probable make-up air is needed. However, if very high natural draft stacks are used on combustion equipment, and high pressure exhaust fans are used in local venilation systems, somewhat higher negative pressure than indicated in Table 1 can be tolerated.

Adding Ventilation

It is possible to calculate or predict the negative pressure within an existing building where mechanical ventilation is planned if certain facts are known. The necessary data are:

(1) Total volume of air to be exhausted plus volume of air for combustion purposes. The latter can be ignored if it is small. Use combustion data from stand-

ard sources such as *Handbook of ACH&V* or the Industrial Ventilation manual of ACGIH.

(2) Total area of openings into buildings into which the air can enter from the outside. This includes window cracks and door cracks but excludes discharge ducts and flues. Any other existing openings, cracks, or holes should be included.

(3) Coefficients of entry (C_e) of openings to air flow.

Item 1 can be determined from the size of the proposed ventilating system. Item 2 is more difficult to obtain but can be estimated by measuring the window and door cracks or from typical window and door opening crack data given in Table 2. The total area of all openings should be determined in square feet.

From an examination and comparison of the shape of the openings of door and window cracks, the coefficient of entry (C_e) can be estimated to lie between $C_e = 0.5$ and $C_e = 0.7$. A value $C_e = 0.6$ can be used for most average openings.

The negative pressure can be then calculated from the equation:

$$Q = 4000\, A\, C_e \sqrt{SP}$$

Under standard air conditions and where

Q = Cubic feet of air per minute exhausted from building,

A = Area of all air inlets in square feet into building,

SP = Static pressure in inches of water, or in this case negative pressure within building,

C_e = 0.6 or coefficient of entry for windows and door cracks.

Solving for SP:

$$(SP) = \frac{Q^2}{(4000\, AC_e)^2} = \frac{Q^2}{(2400\, A)^2}$$

TABLE 1.—NEGATIVE PRESSURES WHICH MAY CAUSE UNSATISFACTORY CONDITIONS WITHIN BUILDINGS

Negative Pressure, Inches of Water	Adverse Conditions Which May Result
.01 to .02	**Worker Draft Complaints** High velocity drafts through doors and windows
.01 to .05	**Natural Draft Stacks Ineffective** Ventilation through roof ventilators, stacks with natural draft greatly reduced.
.02 to .05	**Carbon Monoxide Hazard** Back drafting will take place in hot water heaters, unit heater, furnaces, and combustion processes.
.03 to .10	**General Mechanical Ventilation Reduced** Air flows reduced in propeller type fans.
.05 to .20	**Doors Difficult to Open**
.10 to .25	**Local Exhaust Ventilation Impaired** Centrifugal exhaust fan air flow reduced.

NOTES

Worker Draft Complaint (.01 to .02 inch w.g.)

.01 inch will give a crack velocity of 250 fpm; .02 inch, 340 fpm (see Table 33) according to calculation,

$Q = C_e A\, 4000 \sqrt{SP}$

assuming $C_e = 0.6$

Backdrafting CO Hazard (.02 to .05 inch)

Readings from actual field measurements. Short stacks, low temperature flues.

Natural Draft Ineffectual (.01 to .05 inch)

Short stacks, low temperature flues.

Propeller Fan Reduced Flow (.03 to .10 inch)

A slow speed attic fan would be an example of a very low pressure propeller fan.

From ratings for attic fan:

	At 0 inch SP.	At .1 inch SP.
Fan 1	4,400 cfm	3800 cfm (reduced 13% by 0.1 inch)
Fan 2	13,000 cfm	9020 cfm (reduced 31% by 0.1 inch)

Doors Difficult to Open (.05 to .20 inch)

Doors range in size from 7 x 3 ft upward. For door area, 21 sq ft:

In. w.g.	Lb per sq ft	Total pressure on door, lb
.05	.255	5.5
.10	.51	10.7
.2	1.02	21.4

Local Exhaust Impaired (Centrifugal Fans)

Most sensitive to negative (back) pressure are low speed forward curved centrifugals.

From utility centrifugal rating table:

	Back pres., in.	Capacity, cfm	Reduction
Fan 1	0.125	704	
	.25	531	(28% by .125 inch increase in SP)

However, at higher SP, From rating tables for an industrial fan:

Fan 2	2.25	39,020	
	2.50	35,420	(12.5% by .25 inch increase in SP)

The second case is more realistic for industrial systems. At higher SP the increase of .25" is even less important in reducing cfm. Fan rating tables should be consulted.

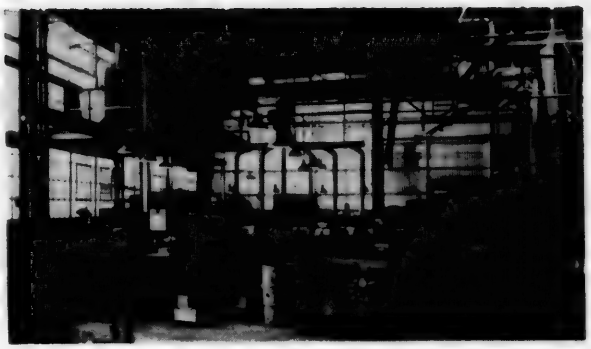


Fig. 2. Overhead unit supplies tempered makeup air.

TABLE 2—CRACK OPENING IN WINDOWS AND DOORS

(For Estimating Air Inlet Openings Into Closed Buildings)

Type	Condition	Crack Width, In.
Wood Sash Window	Average	1/16
Double Hung, Unlocked	Poorly fitted	3/32
Steel Sash Window:		
Industrial Pivoted		1/16
Architecturally Projected	Good	1/32
	Average	3/64
Residential Casement	Good	1/64
	Average	1/32
Heavy Casement	Good	1/64
	Average	1/32
Doors	Well Fitted	3/32
	Poorly Fitted	3/16

Another simpler method of calculating negative pressure is by use of Table 3, which gives negative pressures causing corresponding velocities through crack openings ($C_e = .6$). First determine volume of air exhausted from building under operating conditions. Then determine area of openings into the building. The velocity then can be calculated from:

$$\text{Velocity, fpm} = \frac{\text{cfm air exhausted}}{\text{Area of openings, sq ft}}$$

Look up the pressure in Table 3 corresponding to the calculated velocity. This is the estimated negative pressure within the building.

Example 1: An industrial plant is planning to install a buffing system exhausting 6000 cfm and a paint spray booth exhausting 1600 cfm. The building has 3 well-fitted doors 7 ft x 3 ft and 50 double hung wood sash windows 36 x 60 inches (average fitting). The furnace has been calculated to use 50 cfm of combustion air. What will be the negative pressure in the building? Is make-up air necessary?

Referring to Table 2, widths of cracks are 3/32 and 1/16 inch for doors and windows, respectively.

$$\text{Area of door cracks} = \frac{(3)\,(3)\,(7+7+3+3)}{(32)\,(12)}$$

$$= 0.47 \text{ sq ft}$$

$$\text{Area of window cracks} = \frac{50\,(3+3+3+5+5)}{(16)\,(12)}$$

$$= 4.95 \text{ sq ft}$$

Total area of openings, $4.95 + .47 = 5.42$ sq ft

Total cfm $= 6000 + 1600 + 50 = 7650$ cfm

$$\text{Velocity through openings} = \frac{7650}{5.42} = 1400 \text{ fpm}$$

From Table 3 it is found that an negative pressure of .34 inch water gage will be produced within the building. Make-up air should be provided as shown in Table 1.

TABLE 3—NEGATIVE PRESSURES AND CORRESPONDING VELOCITIES THROUGH CRACK OPENINGS

(Calculated with air at room temperature, standard atmospheric pressure, $C_e = .6$)

Negative Pressure, Inches Water Gage	Velocity, fpm
0.004	150
0.008	215
0.010	240
0.014	285
0.016	300
0.018	320
0.020	340
0.025	380
0.030	415
0.040	480
0.050	540
0.060	590
0.080	680
0.100	760
0.150	930
0.200	1030
0.250	1200
0.300	1310
0.400	1510
0.500	1690
0.600	1860

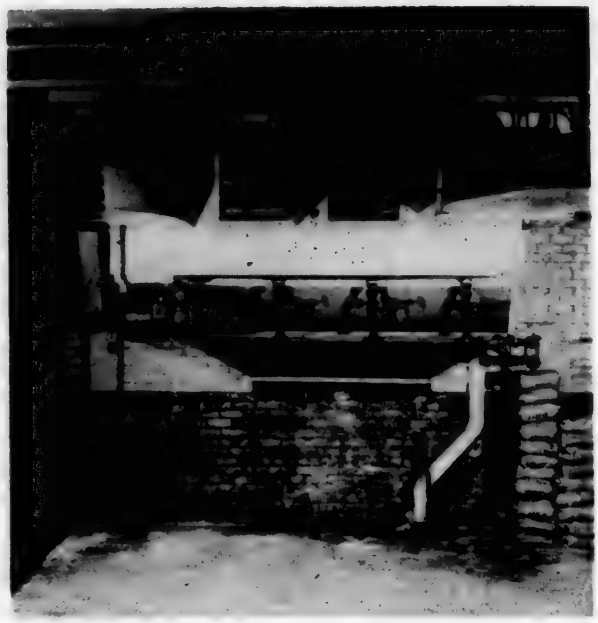


Fig. 3. Make-up air projection unit.

How Much Make-up?

Where an objectionably high negative pressure is known to exist in a building, it is safe to provide a volume of make-up air equal to the total volume of air exhausted or removed from the building, thus maintaining the inside of the building at essentially atmospheric pressure. A unit for admitting and tempering make-up air is shown in Fig. 2. A projection unit for low spaces is in Fig. 3.

If a building contains toxic, irritating, or nuisance contaminants and adjoins buildings with relatively clean air, it is well to maintain the contaminated building at a somewhat lower pressure than the adjoining buildings. This lower pressure should not, however, be high enough to produce any of the adverse effects of high negative pressures given in Table 1. The quantity of make-up air required to maintain negative pressure slightly lower than atmosphere but not low enough to produce adverse conditions can be calculated from the following equations:

$$\text{cfm make-up} = \text{cfm exhausted} - \frac{\sqrt{P_2}}{\sqrt{P_1}}\,(\text{cfm exhausted})$$

where P_1 = negative pressure without make-up, inches of water

P_2 = desired negative pressure, inches of water.

Velocities can also be used from Table 3 as $V_2/V_1 = \sqrt{P_2}/\sqrt{P_1}$

$$\text{make-up} = \text{cfm exhausted} - \frac{V_2}{V_1}\,(\text{cfm exhausted})$$

Example 2: The building in Example 1 was calculated to have a negative pressure of 0.34 inch of water from exhausting 7650 cfm. How much make-up air is required to reduce the negative pressure to .008 inch of water?

In Table 3 find velocities corresponding to .008 and .34 to be 215 and 1400 fpm, respectively. Then

$$\text{cfm make-up} = 7650 - \frac{215}{1400}\,(7650)$$

$$= 6470 \text{ cfm}$$

required to reduce the negative pressure from .34 to .008 inch of water.

Two methods that will

Protect Towers Against Freezing

M. A. RAMSEY
Consulting Engineer, Air Conditioning & Refrigeration Division
Worthington Corporation, East Orange, New Jersey

Herein are detailed two unique methods for automatic protection against cooling tower freeze-up. One is for towers not intended for operation during freezing weather, the other for towers that will be used in sub-zero weather. The first has been in successful operation through two winters in a location near New York City.

IN many offices, theatres, and other buildings, air conditioning is practically a necessity. During periods when the outside temperature is above about 50 deg F, refrigeration is usually required. Unfortunately, days in which the outside temperature exceeds 50 or 55 deg are interspersed considerably with periods during which the temperature is low enough to freeze the water in an unprotected outdoor cooling tower, unless it is drained. This situation requires frequent draining and incurs the trouble of refilling every time refrigeration is required. Sometimes, because of the inconvenience and the time required for filling, refrigeration may not be used, resulting in discomfort for employees or customers.

If all this is considered before an installation is made, it might be decided to use an indoor cooling tower with control of air flow to maintain proper water temperature. An alternative is the installation of the tower outside in connection with a tank indoors. The water would then be recirculated through the indoor tank, passing through the cooling tower only when its temperature was above a predetermined point. With either of these arrangements, freezing is prevented and the refrigeration may be operated regardless of the outdoor temperature.

Tank and Tower Outside

Some air conditioning systems, however, are already installed with outdoor cooling towers and there may be no practical way of installing an indoor tank. Even with a new system, it may be difficult to find space for an indoor tower or even the indoor tank.

Assume a system, with cooling tower and tank outside, designed to remove heat from the condenser of a refrigerating system for air conditioning. Refrigeration

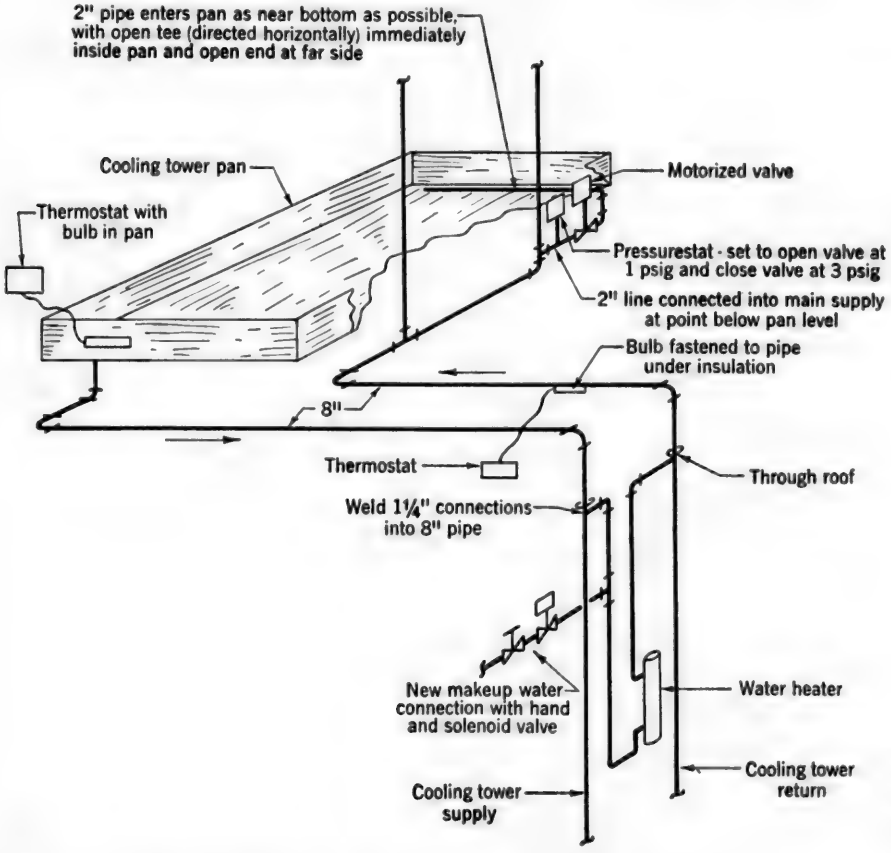

2" pipe enters pan as near bottom as possible, with open tee (directed horizontally) immediately inside pan and open end at far side
Cooling tower pan
Thermostat with bulb in pan
Motorized valve
Pressurestat - set to open valve at 1 psig and close valve at 3 psig
2" line connected into main supply at point below pan level
Bulb fastened to pipe under insulation
8"
Thermostat
Through roof
Weld 1¼" connections into 8" pipe
New makeup water connection with hand and solenoid valve
Water heater
Cooling tower return
Cooling tower supply

Fig. 1. Anti-freeze piping hook-up for cooling tower intended for use during periods when outside temperature is above freezing, Method 1.

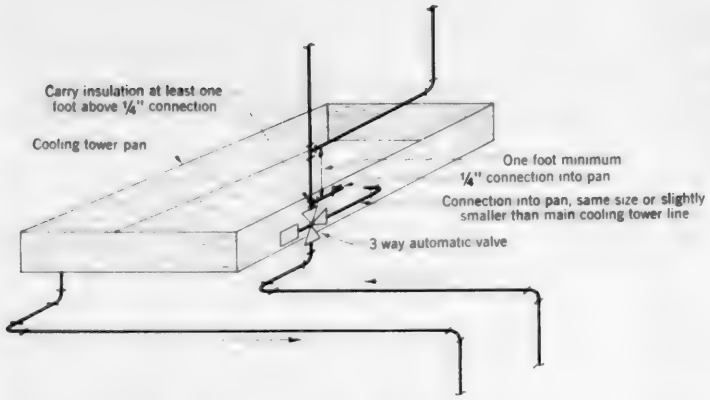

Carry insulation at least one foot above ¼" connection
Cooling tower pan
One foot minimum
¼" connection into pan
Connection into pan, same size or slightly smaller than main cooling tower line
3 way automatic valve

Fig. 2. Modification of piping hook-up in Fig. 1 for towers intended to operate during freezing weather. Method 2.

is necessary only when the outside temperature exceeds about 50 deg. It is desired, though, to protect against freezing so that the system is always ready for operation, and to eliminate the necessity of wondering, "Is the weather going to change and cause freezing tonight? To drain or not to drain?"

Of course, one could solve the problem by putting a steam coil in the tank. Any of the lines outside may be insulated and tracer electric lines might be installed under the insulation to prevent freezing. This requires carrying steam and condensate lines to the roof, possibly requiring cutting and flashing.

A Simpler Solution

In Fig. 1 is shown a solution which seems to the author to be simpler and which has been applied to a tower having a capacity of about 900 gpm through 10 deg with about an 8-deg approach to the wet bulb. The dimensions given apply to this particular case, but they may be helpful in giving some idea of the proportions.

In this method, the cooling tower circulating piping distributes the heat to keep the water in the tank and the pipe above freezing. One thermostat is installed with its bulb in the cooling tower pan and another has its bulb on the tower supply pipe, under the insulation. A connection is made between the pipe which supplies the tower disitribution, and the pan, at a level as near the bottom of the pan as possible.

Connections for a water heater are made into the cooling tower supply and return, just below the roof, as shown. If any of the vertical piping for the cooling tower water circulation is exposed to freezing, the connections would, of course, be made at a point just below the lowest exposed portion. The heater is located at least two or three feet below the connections, more if not inconvenient. It is important that the heater supply pipe drop to the level of the bottom of the heater, connect to it there, and that the circulation should rise through the heater to the other connection.

In this installation, the capacity of the heater is 3 gpm from 40 to 70 deg (45,000 Btu per hr).

The water make-up connection was made to the heater piping, merely for simplicity. It saved making an additional connection to the 8-inch supply pipe. All exposed piping was insulated and the insulation properly weatherproofed.

A pipe with a tee was carried across the tank, as shown, but it is doubtful if this is of any value, particularly with the inlet and outlet diagonally opposite.

How the System Works

The 2-inch motorized valve is controlled by a pressurestat, mounted on the same line. The pressurestat is set to open the valve at 1 psig or less, and close it if the pressure is 3 psig or more. If the pump is not operating, the pressure falls to less than 1 psig (assuming the level of the pressurestat connection is not over 2 ft below the tank water level). When the pump operates, the pressure rises well above 3 psig and causes the valve to close.

When the circulating pump is running, there is a little bypass through the heater line. This could be stopped with a motor-operated valve which opens and shuts at the same time as the valve just described, but the bypass is small and it is doubtful if it is worth installing the valve. (A check valve is not recommended, as the head available to open it is very small.)

Whenever either of the two thermostats indicate a temperature below 35 to 40 deg, the steam valve opens, causing the water in the heater to increase in temperature and rise, resulting in a circulation through the cooling tower piping and tank until both thermostats reach about 40 deg and the steam is shut off.

This arrangement has been in satisfactory operation on at least one cooling tower during the last two winters, in a location near New York City.

An Alternative Arrangement

Another type of heating arrangement, achieved by a revision at the tower connections, permits operation of the refrigeration and tower during periods when the outside temperature is below freezing. The changes in the piping are shown in Fig. 2. Everything else is the same as in Fig. 1.

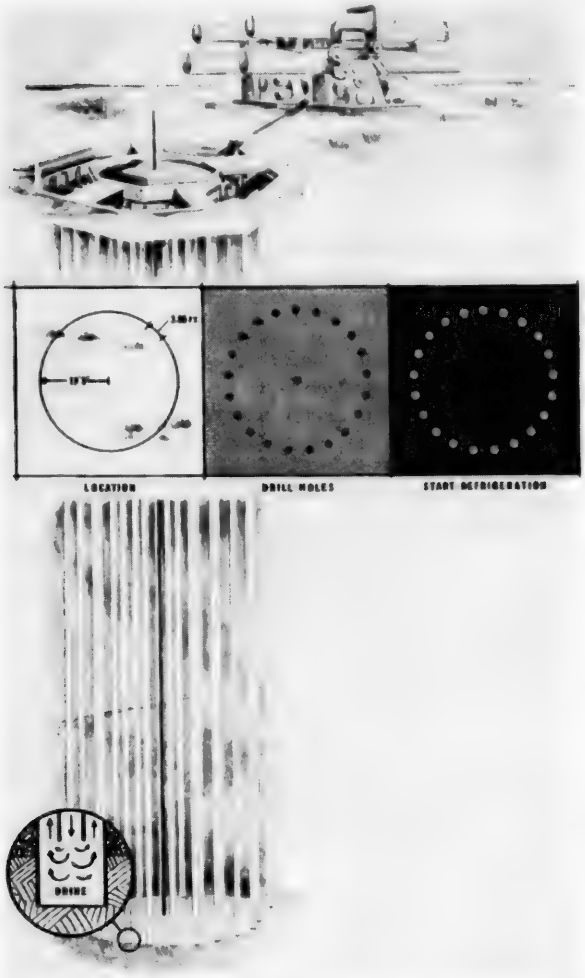
The 3-way valve sends all of the water through the bypass until its temperature reaches, say, 70 deg or some other predetermined temperature, at which time the necessary proportion will go through the tower itself, to be cooled. When the cooling tower pump is not operating, the 3-way valve is open to the bypass.

The ¼-inch line from the 8-inch pipe above the three way valve assures that the tower piping will not contain water much above the valve, either from leakage of the valve or from what is left in the line when the valve closes the main circuit. With the heat transferred through the short length of metal and water and the pipe insulated a foot or more above the tank level, there should be no danger of freezing even the water above the valve if the temperature of the water at the bypass is kept at about 40 deg.

Ground Frozen to Sink Shaft

Refrigeration used to simplify construction of project and to cut customary costs.

REFRIGERATION was employed in making a successful excavation under trying conditions, as part of the Newtown Creek Pollution Project under way at Avenue D and 13th Street, New York City. The reason for this unusual method for sinking a shaft was that the location



Artist's drawing of the system installed to freeze the ground around the shaft. Insert shows the bottom of pipe runs. Other views show arrangement of drill holes.

was close to a large housing project and engineers were afraid of lowering the water table in that area through normal method of sinking casings, followed by continuous pumping.

The method followed was to sink a total of 22 pipes into the ground, arranged in a circle 26½ ft in diameter. After drilling to a depth of 130 ft, the last few feet in bedrock, 6-inch pipes were inserted in these holes. Extreme accuracy was necessary in drilling the holes and the drilling tolerance was plus or minus 25 minutes from the true vertical.

Inside the 6-inch diameter pipe was inserted a 2-inch pipe to within 6 inches of the bottom of the hole. Cold brine is pumped down the 2-inch pipe and flows up inside the larger pipe to a common return line and then back to the refrigeration chiller.

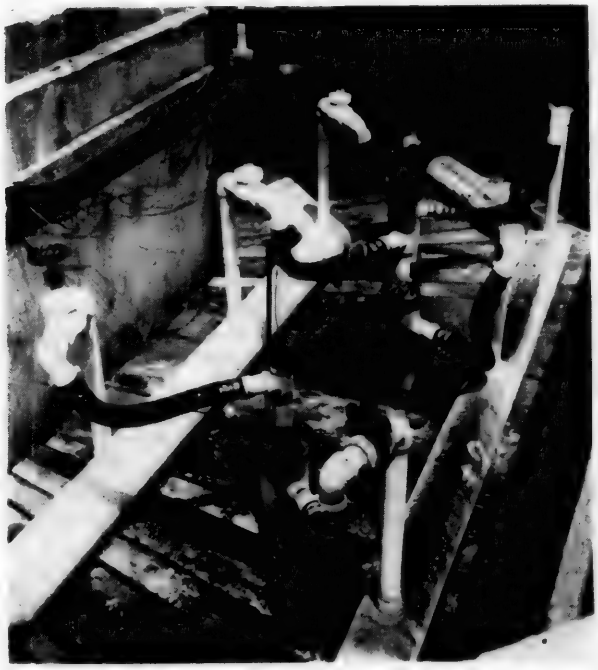
The brine consists of a mixture of diesel oil and kerosene to reduce its specific gravity and thus the static pressure at the bottom of the pipe.

Attached to the exterior of the larger diameter pipe is a thermocouple to read the temperature of the brine at the bottom of the pipe. Another thermocouple on the exterior of the pipe is near the surface of the ground to measure the return temperature of the brine from each pipe to the suction header.

Another pipe, installed in the center of the ring of pipes, has the thermocouples attached to it, spaced every few feet. This is to give the ground temperature at various depths. The center pipe is only for holding the thermocouples and no brine flows through it.

This center pipe does perform another function. When the ground around the entire periphery has been frozen, all water within the frozen area is compressed and is forced out through the center pipe. It is necessary to watch the gage on top of the center pipe to see how pressure is building up, and when to relieve this built-up pressure. Without this relief, the ground may heave.

Refrigeration equipment consists of two 55-ton reciprocating York ammonia brine chillers with the necessary equipment and controls. Each unit and equipment is



Top of pipe showing connections to supply and return headers, and wires from thermocouples.

Circle of pipe installed in ground, without connections to supply and return headers. Left to right are Elmer Nelson, field engineer in charge of job for Poirier & McLane, Inc., and D. F. Ballou, New York office, York Corp.

mounted on a base to increase its resale value after the contractor, Poirier & McLane, Inc., is through using the refrigeration unit.

It is expected that the ground will be frozen, as required, about 45 days after the pumping of brine started. The shaft will then be excavated and the cement poured, using the frozen ground as the form.

After the cement is poured, the frost line will move back several feet due to the heat of hydration during the setting of the cement. This heat also keeps moisture from seeping in until the cement is set. About 21 days are required for the frost line to work its way back to the cement and by that time the cement will have reached three-fourths of its strength.

This construction method has a number of advantages which simplify operation and reduce costs. Sand hogs do not have to work under pressure or in water. When the ground is frozen, no pumping is required to maintain the hole in a dry condition. Ground freezing shows up imperfections in the ground and rock structure.

Consulting engineer for this project is Charles P. Gail of Winston Bros. Company.

Stack Sprays Reduce Soot Emission

All plants that use solid or liquid fuel and most that use gaseous fuel, according to Bituminous Coal Institute, encounter the problem of light deposits on the outside of heating surfaces. These deposits consist mainly of fly carbon and flyash dropped out of the combustion gases as they travel through the boiler. The particles are removed by what is known as a soot blower, although there is not much actual soot in the deposits. Many plants, even though equipped with good flash precipitators, still have trouble with stack emission when blowing tubes or blowing soot.

From the plant operator's viewpoint, blowing soot is a necessary aid to efficient combustion. From the public relations viewpoint, it is a recurring crisis. The trick has been to maintain a clean boiler without soiling the windowsills, washlines, and cars of residents in the vicinity of the plant. Bituminous Coal Research, Inc. recognized that complaints against soot nuisance were a serious threat to the continuance of coal burning, and about two years ago it developed a solution to this annoying problem—the stack spray.

Essentially, the spray is a simple, water spray nozzle mounted in the stack so as to give complete coverage of the cross section of the stack. The spray is turned on during soot blowing and knocks down most of the solid particles entrained in the flue gases as they enter the spray zone of the stack. The particles are deposited in the base of the stack instead of being broadcast over the neighborhood.

BCR research and testing showed that stack spray collection efficiency is a function of the water flow through the nozzle, and that maximum efficiency is obtained by the use of 0.4 gpm per sq ft of stack area. The organization has, in fact, taken all the guesswork out of spray installations through its bulletin, BCR Aid to Industry No. 500-330, which explains the location of the spray, correct nozzle size and pipe diameter, proper water pressure and other details. These instructions have not only simplified installation; if followed closely, they are said to produce phenomenal results.

To date, all installations have been made in brick stacks. Steel stacks introduce another problem, namely, the possibility of corrosion. Installation of a spray in steel stacks might be unwise unless some protection, such as gunite lining or a coating of corrosion-resistant paint, is applied to the lower part of the stack.

ACHV REFERENCE SECTION

Measuring and Controlling

Excessive Heat in Industry

A SYMPOSIUM

An engineering means of measuring how much heat is too much for workers in hot industries (steel, glass, foundry, smelting, etc.) is given with brush-up background in physics and physiology to help engineers design required ventilation and reflective shielding. This Reference Section consists of extensive abstracts of selected papers presented at a symposium on Heat in Industry arranged by the Western New York Section of the American Industrial Hygiene Association. Subjects covered are:

- **The Physics of Radiant Heat**
  by Rev. James J. Ruddick, S. J., Canisius College, Buffalo, N. Y.
- **The Physiological Effects of Heat**
  by Jay B. Moses, M. D., Eastman Kodak Co., Rochester, N. Y.
- **Evaluating Hot Environments**
  by Richard L. Scherberger, Eastman Kodak Co., Rochester, N. Y.
- **Control Methods for Radiant Heat**
  by Karl L. Dunn, Corning Glass Works, Corning, N. Y.

The Physics of Radiant Heat

Rev. JAMES J. RUDDICK, S.J., Ph.D.
Department of Physics, Canisius College
Buffalo, N. Y.

Light, x-rays, radio, and radiant heat are all part of one continuous spectrum. Planck resolves the ultraviolet catastrophe.

HEAT radiation is an electromagnetic wave phenomenon. Heat waves are essentially no different from visible light waves, or radio waves, or x-rays. All are transmitted through space at the same velocity, approximately 186,000 miles per second. In engineering practice, radiated heat from a kiln or furnace may be considered to transfer instantaneously from hot source to recipient or surrounding walls. It is absorbed only slightly by the air through which it passes, although this air may become heated by contact with the hot source or the warmed surface on which the radiation impinges.

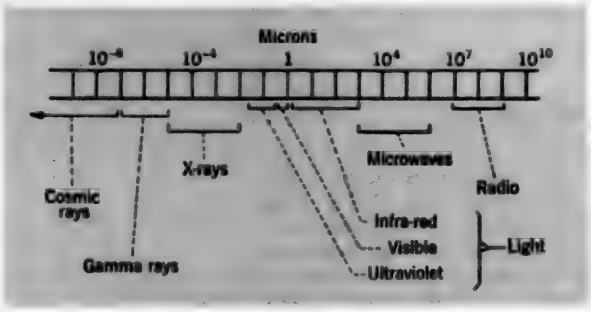


Fig. 1. Electromagnetic spectrum.

Figure 1, of the electromagnetic spectrum, shows that thermal radiation (the infra-red region) is merely a part of a wide spectrum of waves of differing energy and wave length. That energy, for any given wave, is given by Planck's Law: $E = hf$, where h is a constant established by Max Planck and f is the frequency of the wave in cycles per second.

A key notion in the physics of radiation is that of the "black body." It can be shown (Kirchoff's Law) that the rates of radiation of any two surfaces have the same ratio as the absorption factors of the two surfaces. Good absorbers are good radiators. The best absorber is one that absorbs everything and reflects nothing; this is called a "black body." It would actually appear black unless its temperature were high enough to make it luminous by itself. Practically, there are materials of various colors and textures that have high degrees of absorbtivity (and, hence, emissivity), although lower than that of the perfect black body.

Figure 2 shows curves of relative energy intensity radiated at various temperatures, taken in part from experimental data of Lummer and Pringsheim (1897, 1899, and 1900). Classical theory at the time explained the long wave-length end of the curves, but predicted an indefinite increase in intensity as the wave length decreases. Such a prediction for a black body at 2100 deg C (3812 deg F) is shown by the broken line curve. This "ultraviolet catastrophe," as it was called, could not be removed until Max Planck in 1900 made his bold hypothesis that atoms could radiate energy only in discrete amounts according to the law $E = hf$. After Planck, physics was never the same at all.

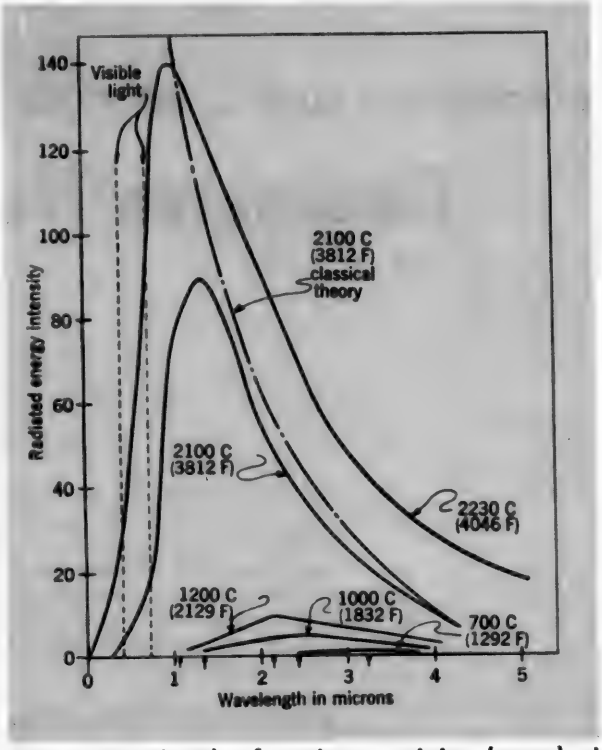


Fig. 2. Wavelength of maximum emission (arrows) at various temperatures. Note that this wavelength times absolute temperature equals a constant.

The size of these discrete amounts or particles of energy does not depend on temperature, but the number of such particles emitted (hence the total quantity of heat emitted) and the wave length of maximum energy radiation do depend on the temperature of the black body. Figure 2 shows the great significance of this temperature dependence of the total radiated energy. Accord-

ing to the Stefan-Boltzmann Law, the amount of energy radiated by a black body per square centimeter per second is proportional to the fourth power of the absolute temperature: $W = \sigma T^4$. The constant σ is the same for all black bodies and is called the Stefan-Boltzmann Constant.

The wave length of maximum energy emission is established by Wien's Displacement Law, which says that the wave length of maximum energy emission multiplied by the absolute temperature of the radiating body is a constant. Figure 2 shows these energy peaks at the several temperatures and indicates the corresponding wave lengths by small arrows. Note also that the area under each curve is proportional to the total energy radiated at that temperature. Note how little of the total is in the visible range, even at high temperatures.

The amount of such energy received and taken up by objects in the vicinity of heated radiating bodies depends on the size, temperature, and character of the radiating body; and the distance and size of the receiver, the absolute temperature of its surface (the higher, the less heat absorbed), and the absorptive characteristics of its surface.

What about non-black bodies? They can be handled—at least to some extent and for equilibrium conditions—by the consideration that their absorptivity (and hence emissivity) is proportional to that of a black body. For a body of absorptivity α, the power radiated per unit area can be taken as $W = \alpha\sigma T^4$. Applying these ideas to non-equilibrium conditions, we are led to the conclusion that, under the same conditions, a black body, in cooler surroundings, cools more rapidly than a non-black body.

Similarly, heat transfer is faster and more efficient between two "black" surfaces, one of which is hotter than the other, than between black and non-black or between two non-black surfaces. The least effective or efficient transfer is between bodies, one or both of which have highly reflective surfaces to infra-red waves. Obviously, these considerations are extremely important for the application of radiant heating to industrial, commercial and domestic uses, and to the protection of personnel from excessive heat radiation.

The Physiological Effects of Heat

JAY B. MOSES, M.D.

Medical Department, Eastman Kodak Company
Rochester, New York

Blood, sweat, and hormones help make of man a liquid-cooled, fuel-burning, black body.

THE human body makes use of highly complicated physical, chemical, and neurological mechanisms to maintain optimum heat balance over a fairly wide range of environmental temperature change without placing serious stress upon the organism.

Under conditions of comfort, this balance can be expressed as $M \pm S - E \pm R \pm C = 0$, where

M = metabolism (always positive)
S = storage
E = evaporation (always negative)
R = radiation
C = convection

The body, for purposes of temperature determination, can be divided into two regions—the deep and the peripheral. About one-half of the human body lies in the peripheral region within one inch of the surrounding air. The deep temperature is nearly uniform, varying only about one degree; the peripheral temperature is widely variable, over a range of about ten degrees. Oral temperature is a mixture of the two. Even when the body is at rest, there is a temperature gradient between the deep and peripheral zones. It is this deep, or core, temprature that is the most critical and upon which the maintenance of normal metabolic function is in part dependent. The heat regulatory mechanisms are all directed toward maintaining the relative constancy of this core temperature.

An increase in the production of heat by muscular work must be balanced by an increase in the rate of heat loss. In environments above skin temperature, the body gains heat through radiation and convection. This increase in heat load, together with heat from metabolism, must be eliminated by the only remaining avenue, evaporation. Large amounts of heat can be thus dissipated. The limit of evaporation is reached when the body surface becomes fully wetted; and if the heat load exceeds the maximum evaporation capacity, the body heat rises.

Let us consider what happens when the deep body temperature begins to rise as a result of the above factors. First, by the dilatation of the vessels of the skin, blood is diverted from the internal regions to the external surfaces, thereby increasing heat loss. Second is an increase in blood volume brought about by dilution with fluid drawn into the circulation from the tissues (chiefly the skin, muscles, and liver), and by blood from the spleen. These changes in blood volume are of paramount importance in temperature regulation.

Third is an increase in the circulation rate. Volume output of the heart is increased, if the environmental temperature exceeds 86 deg F, by 5 to 30%, chiefly by an increase in heart rate.

The anatomical arrangement of the vessels of the skin is an aid to heat regulation, for the arteries first pierce the muscular layers before reaching the skin, and so pick

up muscle heat and bring it to the surface. On exposure to heat, and in muscular exercise, most of the blood that has passed through the small arteries and capillaries of the skin returns via a network of dilated superficial veins where it continues to be cooled. The extremities are the most effective areas of heat dissipation. Blood flow through a finger can change through a range of 0.5 ml to 90 ml per min per 100 ml of tissues, through a hand from 1 ml to 20 ml.

Small, very numerous, widely distributed sweat glands, whose secretory action is widely variable, play the primary role in the production of sweat. The average man has about 2,500,000 of these sweat glands, whose secretory action depends chiefly upon changes in skin and temperature, and usually occurs when the skin temperatures goes over 94 deg F, or when blood temperature goes up about one degee. In muscular exercise, sweating may begin before the deep temperature actually rises. Sweating cools only inasmuch as it evaporates; evaporation is enhanced by air movement and the removal of clothing. The efficiency of evaporation depends upon the ambient vapor pressure and relative humidity, and at elevated environmental temperatures this may be the limiting factor.

Chemical Control

Not the least important factor in the body's temperature regulation is chemical control. This control is effected by changes in the amount of combustion going on in the tissues. The percentages of total metabolic heat generated in different parts of the body are accurately reflected in the total oxygen used by those regions.

Under basal (resting) conditions, the internal organs (liver, spleen, kidneys, intestines, brain, and heart) which together compose 7.3% of the body weight, account for 57.6% of the total oxygen consumption. This is in contrast to that of the resting skeletal muscles which make up 50% of body weight but use only 20% of the total oxygen consumed. This distribution changes radically during muscular exercise. In moderate exercise, the total heat production rises to three times the basal level and 70 to 80% of it is generated in the peripheral muscles.

Heat is also produced by the specific action of foodstuffs. In winter, there is a tendency to ingest more protein foods; in summer, the reverse is true.

The metabolic rate is influenced by certain of the glands of internal secretion. The thyroid gland exerts the greatest direct action upon heat production, but is not subject to rapid changes. Its activity is directed toward the basal rate of tissue combustion, and may be of some importance in slowly developing adaptations.

The activity of the adrenal medulla is known to be rapid and induced by nervous control. Epinephrine, its secreted hormone, has a known calorigenic action in the body and probably does play an active part in the processes of temperature control.

As we have pointed out before, when the body temperature continues to rise in spite of its efforts to dissipate heat, a condition of serious strain develops. There are workable formulae which can be applied to a given environment to determine, often in advance, how much heat strain will be imposed upon the worker. One of these is the formula devised by Belding and Hatch by which a heat stress index is calculated. This Stress Index is arrived at by calculating the $E_{req.}$ (the evaporative heat loss required for thermal balance $[M+R+C]$) and $E_{max.}$ (maximum evaporative capacity) and utilizing the formula, $E_{req.}/E_{max.} \times 100 =$ Stress Index. A Stress Index of 100 is that which represents the maximum stress tolerated daily by fit, acclimatized young men. (The Stress Index is discussed more fully in the paper which follows, Evaluating Hot Environments, by R. F. Scherberger.)

In mild to moderate heat stress, with an index of 10 to 30, the important factor is the screening of the borderline individual who has some cardiovascular limitation, and whose ability to perform muscular work at the level of zero heat stress is marginal.

In severe heat stress, with an index of 40 to 60, it is necessary that workmen be physically fit and acclimatized. Persons with cardiovascular or respiratory impairment, or with chronic dermatitis, should be excluded; the last because the sweat glands are "knocked out" by extensive, chronic dermatitis.

In very severe heat stress, with an index of 70 to 90, the important factors are, first, the selection of fit personnel who can acclimatize to hot environment; and second, prompt removal of temporarily indisposed persons from the hot atmosphere until there is complete recovery. In these workers, the psychological reaction to heat is of paramount importance. Adequate salt and fluid intake is imperative.

Acclimatization, characterized by the ability to work with less rise in pulse, less rise in deep body temperature, and secretion of less (but a more dilute) sweat, occurs in from one to two weeks. In this period, concentration of sodium chloride in urine and sweat is lowered, being conserved by the kidney. Renal conservation of NaCl seems to be the real key to acclimatization, caused, at least in part, by an increase of adrenocortical activity.

Life and Death at Boulder Dam

David B. Dill in his studies of workmen during the building of Boulder Dam observed that the urinary output of workers was markedly reduced during the first few days, or weeks, in the desert. One man passed no urine at all for the first three days on the job.

Unfortunately, man, unlike the horse and ox, does not crave salt, even when it is badly needed. If the sweat glands continue to excrete a larger quantity of salt than is ingested, thirst and renal activity are adjusted so that the extra-cellular water of tissues is reduced; and, for the time being, normal osmotic pressure is maintained in the tissues. If salt and water depletion continues, and if the subject is doing hard work, fatigue, cramps, or heat exhaustion may ensue. These reactions generally occur in exposure to dry heat which allows for ample cooling by evaporation of sweat and when the loss of salt and fluid is not replenished.

When one does not sweat enough, or when the environment is too humid, or clothes too impervious, one may get heat stroke or prostration. Heat stroke is a failure of adequate heat elimination, almost always related to

a breakdown of the sweating mechanism; it may occur whenever heat regulation is dependent on sweating for long periods of time. Heat stroke rarely occurs if relief from sweating is afforded during part of the day; such as in desert areas with cool nights, or where air-conditioned sleeping quarters are available. It is interesting to note that Dill records during the first year of the building of Boulder Dam there were 15 deaths from heat stroke and innumerable cases of cramps and exhaustion. The men slept in quarters near the dam. Shade temperatures during the day were as high as 127 deg F. and temperatures at night often remained above 100 deg. until after midnight. The second year, the barracks were air-conditioned and moved to the plateau near Boulder City. There were no deaths from heat and only 5 cases of cramps.

We have talked about physical and physiological reactions to heat. There is another important reaction—the psychological, or I suppose one might term it, psychophysiological, since the physiological response can be influenced by psychological reaction. Extremes of heat and humidity affect the worker psychologically in two ways.

1. Marked emotional states (anger, fear, jealousy, etc.) are known to increase body temperature and general bodily discomfort.
2. Attitudes of resentment and antagonism tend to lower the threshold of perception of heat and so increase the susceptibility of the worker to its harmful effects.

The individual's physical reaction to heat is seriously affected by his attitude and personality. His discomfort may be affected more by how he feels about the heat than by the actual temperature. Therefore, the way he feels is affected both by the emotional and physical atmosphere in which he works. Even animals exhibit increased irritability in hot weather and we have the term "dog days" for that hot, humid period of the year.

Increased irritability and belligerence, increased sense of fatigue, increased anxiety and apprehension, and the inability to concentrate may lead to accident proneness, unnecessary time off, work spoilage, labor turnover, low productivity, lowered quality of production, and low morale.

In summary: The human organism is not passive to its thermal demands. Certain functions must be constantly performed to maintain its own approximately constant deep body temperature, for upon the constancy of this temperature depends the health and comfort of the individual. The process of heat generation (metabolism) is chemical, and that of heat loss is physical; the complex physiological thermoregulatory mechanisms are directed toward maintaining the optimum balance between the two.

Evaluating Hot Environments

RICHARD F. SCHERBERGER, M.S.

Laboratory of Industrial Medicine, Eastman Kodak Company
Rochester, N. Y.

Working and recovery time can be calculated by use of a Heat Stress Index.

THE human body will, during the performance of any given task, generate the same amount of heat in either winter or summer. This quantity of heat is the sum of two components: a relatively constant basal metabolic heat production, plus the added metabolic heat resulting from the fluctuating energy requirements of the task. The body maintains thermal equilibrium primarily by mechanisms for regulating its rate of heat loss.

In environments which we term comfortable, approximately 60% of metabolic heat is lost by radiation; the remaining by evaporation and convection. Other minor modes of heat transfer, as for example via the respired air and loss in urine and stools, normally have little effect on the overall heat balance of the body.

Heat exposures may be categorized as being either hot-dry or warm-moist. In a hot-dry environment, if the solid objects surrounding the worker are hotter than skin temperature, the radiant heat gain may exceed the capacity of the sweating mechanism to provide sufficient cooling, and body temperature will rise. In a warm-moist environment, heat load from radiation may not be great but the humid environment severely limits the sweating-convection mechanism. Body temperature will rise when the maximum evaporative capacity is insufficient to permit dissipation of the body's heat load.

Measurement of Heat Stress

Within the last few years, two reports by Haines and Hatch *(Heating and Ventilating,* November, 1952) and Belding and Hatch *(Heating, Piping and Air Conditioning,* August, 1955) describe a method of evaluating the stress imposed on a worker by a hot industrial environment. They also permit an estimation of the resultant physiological strain. The theoretical approach used by these authors, reduced to its most workable form, may be expressed as

$$E_{req} = M \pm C \pm R \qquad (1)$$

The evaporative capacity required (E_{req}) to maintain

body heat balance is equal to the sum of the heat loads imposed on the body by the metabolic process *(M)*, by convection *(C)*, and by radiation *(R)*.

It should be noted that C and R will usually be negative. In hot industrial environments, however, one or both of these values may become positive and represent sources of environmental heat stress.

The first step in the practical application of this method involves the measurement of four environmental parameters: (1) ambient dry bulb temperature (T_a); (2) wet bulb temperature; (3) black globe temperature (T_g); and (4) air velocity (V). We can then utilize the following equations proposed by Belding and Hatch:

$$C = 2V^{.5}\,(T_a - 95) \qquad (2)$$

$$\text{and } R = 22\,(T_w - 95) \qquad (3)$$

$$\text{where } T_w = [T_g^4 + .103 \times 10^9\, V^{.5}\,(T_g - T_a)]^{.25} \qquad (4)$$

The term T_w represents the average temperature of the solid surroundings and may be though of as wall temperature. Solving these equations gives us values for the heat loads resulting from radiation and convection. (The same information may be obtained by those having little love for mathematics by consulting nomographs given in the previously mentioned reports.) Representative values for the metabolic heat produced in various degrees by physical activity are given in standard references so that it becomes possible to determine the value for the full heat load imposed upon the body, $M + R + C$.

The maximum evaporative capacity (E_{max}) of the working environment depends on air velocity and water vapor pressure both in air and at the skin surface. Wet bulb readings permit the determination of the vapor pressure of water in air (P_a). We may substitute in the following equation:

$$E_{max} = 10.3\ V^{0.4}\,(42 - P_a) \qquad (5)$$

This equation has been derived on the assumption that skin temperature is 95 deg F (an assumption erring on the side of safety). Again, nomographs permit the determination of E_{max} without recourse to the equation.

If E_{req} exceeds E_{max}, the excess represents the rate of heat gain by the body. The "average" man will undergo a 2 deg F rise in temperature for each 250 Btu gained. This rise is assumed to be the maximum that can be tolerated without untoward effects. It follows that the ratio $250/(E_{req} - E_{max})$ represents the permissible exposure time (in hours). This limit governs the exposure of the healthy, acclimatized, semi-nude male upon which these considerations are based.

The evaporation of one liter of sweat will dissipate 2400 Btu. Considering the results of extensive physiological research Belding and Hatch make the premise that the average, young acclimatized male cannot sweat at a rate greater than one liter per hour for eight hours without undergoing deleterious effects. Such a sweat rate is assigned a Heat Strain Index (HSI) of 100 and is reached when E_{req} equals 2400 Btu per hr. In other words, where the limiting factor is the body's sweating capacity:

$$\text{HSI} = \frac{E_{req}}{2400} \times 100 \qquad (6)$$

Where the evaporative capacity of the environment is limiting (i.e., less than one liter per hour), the heat strain index must be based on E_{max} as:

$$\text{HSI} = \frac{E_{req}}{E_{max}} \times 100 \qquad (7)$$

Under these latter conditions, a HSI of 100 is reached when $E_{req} = E_{max}$. Again, this is considered the maximum that the healthy young adult male can tolerate for eight hours. Where employees include those who are obese or who suffer from a cardiac disorder, recommendations must be weighed accordingly, since a HSI of considerably less than 100 will be tolerated.

Most industrial heat exposures do not last for the full working day. The employee will often retire to cooler areas away from the heat source. These areas are termed the recovery environment. There are obvious advantages to subjecting the recovery environment to the same type of heat analysis employed for the work site. In such a relatively cool area, E_{max} will exceed E_{req}. The difference represents the cooling capacity of the environment so that

$$H_r = \frac{250}{E_{max} - E_{req}} \qquad (8)$$

Where H_r will be the hours required for body temperature to return to normal after undergoing a 2 deg rise.

Method Applied

Table I illustrates the application of the method proposed by Haines, Belding, and Hatch to analyze an actual work situation. The operations studied involved the several phases of a metal smelting process.

To compile Table I, the heat loads imposed by metabolism, radiation and convection were first determined by measuring the environmental parameters in the recovery area and at each exposure site. Next E_{req} and E_{max} for each operation were determined and the heat strain index was calculated.

In operations 1 to 5, E_{max} was the limiting factor so that HSI = $100\ E_{req}/E_{max}$. In operations 6 and 7 the body's sweating capacity became limiting and HSI = $100\ E_{req}/2400$. Next the Heat Strain Index for each task was weighed by the exposure time.

The maximum allowable exposure time (H_a) was determined from the ratio $H_a = 250/(E_{req} - E_{max})$.

The Recovery Time Ratio is defined as H_r/H_a. This ratio actually shows the number of hours which must be spent cooling off in the recovery area for each hour spent in the exposure area. A man spending his eight hour day performing the tasks as described in Table I would be in a recovery environment for 3.75 hours; however, for 3.10 hours his temperature would theoretically be above normal and his sweating mechanism would be working at full capacity, leaving only 0.65 hours of true rest. Thus, to determine the weighed index for his time in the recovery area, an index of 100 was assigned for 3.10 hours while the remaining 0.65 hours was given the index of 128; this describes the entire series of tasks encountered at this particular work site, and would appear to indicate a severe heat exposure. The exact physiological significance of such a high index number merits further study.

In examing this essentially engineering approach to a

TABLE I.—CALCULATION OF AN OVERALL HEAT STRAIN INDEX FOR A PARTICULAR AREA

Operation	(A) Hours Per Day Spent at Task	(B)* Metabolic Heat Load M	(C) Radiant Heat Load R	(D) Convective Heat Load C	(E) E_{req}	(F) E_{max}	(G) Heat Strain Index	(A x G) Weighted HSI	(H) Max. Allowable Exposure (hours)	(I) Recovery Time Ratio	(A x I) Recovery Time Required to Reach Normal Body Temp. (hours)
1. Pouring from casting furnace.	0.75	1160	2800	300	4260	1680	254	190	0.10	1.6	1.2
2. Pouring from remelt furnace.	0.75	1160	2800	—130	3830	1600	239	179	0.11	1.5	1.1
3. Skimming slag.	0.25	1160	400	—100	1460	1380	106	26	3.12	0.5	0.1
4. On platform by remelt furnace.	1.00	1400	1220	0	2620	1475	178	178	0.22	0.7	0.7
5. Adding metal to casting furnace.	0.50	1400	0	—150	1250	1280	98	49	no limit	—	—
6. General area (heavy work).	1.00	1400	380	—150	1630	2430	68	68	no limit	—	—
7. Recovery environment.	(3.75)	560	380	—150	790	2430	(33)	(124)	no limit	—	—
							HOURS OF RECOVERY TIME SPENT COOLING OFF =				3.10
8. Reevaluation of strain of recovery environment.	3.10	Hours spent cooling off					100	310			
9.	0.65	Hours of actual rest					33	21			
	8.00							8|1021			
								128 = Weighted Job Index			

* Columns B through F are expressed in Btu per hour.

physiological problem, one naturally wonders how well theory agrees with fact. Does this approach apply to the non-average industrial worker who does not trek about the plant semi-nude?

Turner in Britain has reported *(British Journal of Medicine,* Vol. 14, 1957) that this theoretical approach works best where it is most needed—in hot areas where E_{req} is about 2000 Btu per hr. Less agreement was found in cooler areas, which Turner believes may result from underestimating the metabolic heat load. He found that the mean value of observed heat loss by sweating was only 8½% in excess of the predicted rate.

Further work appears necessary, but this approach to heat analysis appears highly useful and workable at its present stage of development. The technique of separating the total heat load into its components furnishes a guide for engineering excess heat out of the work environment and is especially valuable.

Control Methods for Radiant Heat

KARL L. DUNN

Manager, Safety & Industrial Hygiene, Corning Glass Works
Corning, N. Y.

Understanding radiant heat and physiology leads to control by shielding and air movement

SEVERAL years ago, largely through the efforts of Theodore Hatch, now Professor of Industrial Hygiene at University of Pittsburgh's Graduate School of Public Health, attention was directed to several misconceptions then existing of modes of heat loss and gain by personnel exposed to hot operations in industry.

Prior to these initial observations, the hot industries had concentrated their efforts toward worker comfort on warm air or convective heat suppression. Recognition by Hatch that more than 50% of the heat loss from hot furnaces and equipment was by direct radiation to cooler surfaces and personnel set the new trend of radiant heat shielding, now familiar to most hot industries.

Probably the best explanation of the importance of controlling radiant heat is the familiar Stefan-Boltzman equation, which states that the total amount of radiation emanating from a hot surface is proportional to the fourth power of the absolute temperature of the radiating source. A simple example of applying the Stefan-Boltzman equation to a hypothetical furnace operating at 1000 deg K and then increasing the temperature 10% and 100% shows a corresponding increase of 44% and 1500% re-

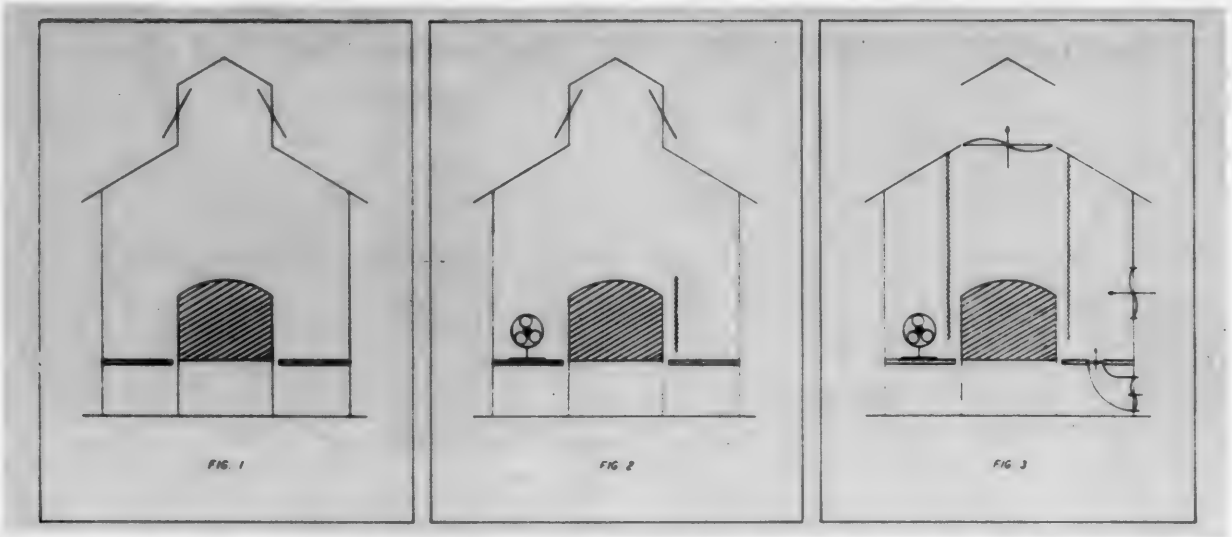


Fig. 1, 2 and 3. Evolution of methods for handling heat problems around a central furnace, showing (1) simple convection through monitor, (2) forced convection and partial iron or asbestos shielding, and (3) full reflective shielding, powered monitor, controlled outside air supply.

spectively in the amount of radiant flux per unit area of furnace, assuming an emissivity of 1.0. The relationship between temperature increase and radiant flux and the effect of the fourth power of the temperature is thus forcefully demonstrated.

An observation made by use of a simple thermopile exposed in a factory workspace demonstrated that radiant heat was a factor in heat loss from furnaces. Interposition of any opaque object between the thermopile and the furnace resulted in an immediate reduction in radiant flux. For short term exposures any opaque material was found to work satisfactorily but as certain materials were left exposed for long periods they became hot by absorbed radiation and in turn began to radiate themselves. Because these makeshift screens were nearer to personnel than the original radiator, the problem was only intensified. It then became apparent that a material was needed which had a low absorptivity to radiated heat—which meant we must look for a good reflector.

A search of the records resulted in a list of materials that might be considered (Table I). Materials such as gold, silver and platinum were immediately abandoned for economic reasons. Materials that we commonly think of as good for heat insulation or reflection such as white paint, aluminum paint and asbestos were likewise abandoned when it was discovered they had low reflectivity to the infra-red portion of the spectrum. Aluminum metal seemed to be the ideal choice from the standpoint of cost and maintenance, as it does not oxidize readily as do copper and zinc. When it does oxidize, the thin layer of aluminum oxide has nearly as high reflective powers as does the parent metal.

Since the earlier examination of materials, several new ones have been created, one of the most interesting of which is a transparent glass having up to 70% reflectivity to radiant heat. This allows many applications of radiant heat shielding, previously impractical, where high visibility is needed but radiation reduction is imperative.

TABLE I.—PERCENTAGE REFLECTION OF VARIOUS POLISHED METALS AT WAVELENGTH 2 MICRONS

Metal	% Reflected
Antimony	60
Bronze	80
Copper	95.5
Gold	96.8
Iron	78
Magnesium	77
Nickel	83.5
Platinum	80.6
Aluminum Paint	50
Silver	97.8
Speculum	80.4
Steel	76.7
Tungsten	85
Aluminum	92
Tin	61
Zinc	92
Asbestos Paper	5-10
White Lacquer	5-10

Applications

Figures 1, 2 and 3 illustrate schematically the transition in methods of handling heat problems in a high temperature industry. Figure 1 represents a typical high temperature operation. A centrally located furnace supported on columns at the second floor level has as its only means of losing heat direct radiation to surrounding surfaces and people and convective air currents rising around it to the simple monitor in the roof. This was the condition in most hot industry for many years.

The diagram (Fig. 2) of the next phase represents the stage of attempting to cope with heat by means of induced convection or fan air. This system only circulated the air around the work areas and in many cases intensified the problem by picking up air from hot areas and blowing it over the workmen. It did not affect radiant heat, of course. We cannot bend a beam of light (infra-red) by blowing air upon it. The beginnings of radiant heat shielding are recognized in this drawing as

Fig. 4. Extensive reflective shielding salvages formerly intolerable area for time clerk. Note firebox below shield at left.

wavy lines at one side of the furnace. Materials such as black iron, asbestos, etc. were used to a limited degree in this period but with the result of reradiation described previously.

Figure 3 represents the application of our present knowledge of radiant heat shielding.

We continue to use induced mechanical air circulation but to a limited degree. Permanent air supplies using outdoor air (sometimes refrigerated) are more common than the portable fan. Radiant heat shielding in the form of corrugated aluminum walls are dropped from the interior roof structures to within two or three feet of the floor. This results in a huge "hood" completely surrounding the hot object or furnace. To minimize the possibility of large friction losses preventing the escape of convected heat we literally open up the roof. In some cases we install power roof monitors to assure positive air flow inside the shield structure. These shields prevent radiation from escaping from the furnace to either surrounding work areas or personnel. Generated gases stay within the structure as well. With all of the attention to positive air flow and the high reflectivity of the shield walls the rest of the factory can be maintained within a few degrees of ambient outdoor temperatures

Fig. 5. Gravity and powered roof ventilators over shielded areas of plant.

Fig. 6. Use of infra-red reflecting glass in a steel mill.

and radiant heat effects on personnel are kept to a minimum.

These structures, illustrated in Fig. 4, were constructed by nailing aluminum roofing on to a light steel framework. The entire structure was fastened together quickly by means of the now familiar blank cartridge actuated pressure gun. Some openings are necessary for service lines, etc., but the overall effect is near the theoretical result expected. Figure 4 illustrates better than radiometer readings the practical result. The area in which the worker is seated was previously so intolerably hot that it was necessary to run almost through the area to avoid the radiant heat from the furnace whose fire-box can be seen under the shield. The low emissivity (or high reflectivity) of the aluminum is well demonstrated by the fact that time card racks could be installed directly on the shield.

Figure 5 shows the extensive use of both gravity and power actuated roof ventilators over the shielded areas of the plant. It cannot be overemphasized that free air flow from floor to roof on the interior of the shielded areas is imperative to prevent build-up of heat and gasses.

Figure 6 shows the use of the new transparent infrared reflecting glass in steel mill operations. It also illustrates a concept of radiation shielding which encloses personnel from the hot process rather than attempting extensive shielding of large areas in a plant in which no personnel exposure is experienced. This new material offers many possibilities by itself or in conjunction with other shielding materials. As stated previously, the reflectivity is high, emissivity low and the ability to withstand heat shock is excellent. Crane cabs, pulpits and other control areas come to mind as immediate possibilities for application. There are probably many more.

One new application of radiant heat control is reduction of the emissivity of hot objects. Most refractories and kiln shells are constructed of materials with an inherently high emissivity. Application of low emissive skins of aluminum foil directly to these objects with temperataure resistant adhesives has resulted in one application in a 40% reduction of radiant heat. This concept has not been extensively explored as yet but in the future this reduction in emissivity and further application of hood shielding should result in the ultimate in radiant heat control in the hot trades.

Wiring Diagrams for, and Control of Reciprocating Refrigeration Compressors

W. G. WASSMANDORF
Manager, Reciprocating Compressor and Cold Generator
Sales Dept., The Trane Company

EFFECTIVE control plays a vital part in the efficient operation of all refrigeration and air conditioning systems. Good controls and a carefully designed control circuit make the system more versatile and economical to operate.

Refrigeration and air conditioning controls fall into two categories—operating controls and safety controls. Operating controls are those that start, stop and regulate the system. Thermostats, solenoid valves and expansion valves are operating controls.

Safety controls are those that protect equipment and system components from damage that would be caused by abnormal operation. Motor overloads, oil pressure safety switches and high and low pressure cut-out switches are safety controls. Many localities have established codes requiring the use of adequate safety controls.

There are several types of control systems that may be effectively used with refrigeration systems. Probably the most common is the "pump-down" system.

Pumpdown System Control

The sequence of control, in this typical system, begins with the start of the air conditioning unit fan motor. This is done manually by means of a pushbutton. All of the remaining controls function automatically.

After the start of the unit fan motor, control of the system is taken over by a thermostat in the conditioned space. Responding to changes in the conditioned space temperature, this thermostat opens and closes a solenoid valve. The solenoid valve opens on a rise in temperature and allows refrigerant to be metered through the thermostatic expansion valve and into the cooling coil, where it evaporates. The refrigerant leaves the coil as a gas and passes through the suction line to the compressor. This flow of refrigerant through the coil results in an increase in suction pressure. When this pressure reaches the cut-in setting of the low pressure element in the dual pressure control, the contacts of the dual pressure control close, and the circuit to the compressor motor magnetic starter is energized.

Although the oil pressure safety switch is in the control circuit between the dual pressure control and the compressor motor starter, the contacts of the oil pressure switch are normally closed. Therefore, it can be said that the compressor motor starter is energized directly from the dual pressure control.

Oil Pressure Safety Switch

When the compressor starts, an electrical circuit to the oil pressure safety switch energizes a timing device. This device will interrupt the electrical circuit to the compressor starter holding coil, and thereby stop the compressor, if it is allowed to run the length of its timing cycle. Provided the oil pressure delivered to the compressor reaches a safe limit before this device "times-out," the timing cycle will stop and the compressor will continue to operate. If the oil pressure does not reach this safe limit, the contacts of the oil pressure safety switch will open and stop the compressor.

Should the oil pressure drop below a safe limit at any time during compressor operation, the timing mechanism will be energized and will time-out to stop the compressor before the lack of lubrication causes damage.

Dual Pressure Control

The dual pressure control contains two pressure elements connected to a common set of switch contacts. The high pressure element opens these contacts to stop the compressor when the discharge pressure becomes abnormally high. The low pressure element opens the contacts when the suction pressure drops below a set minimum.

During normal operation the system will start and operate until the thermostat in the conditioned space is satisfied. This thermostat then opens the electrical circuit to the solenoid valve, stopping the flow of refrigerant. The compressor will continue to run, however, until the suction pressure is reduced to the cut-out setting of the low pressure element in the dual pressure control.

Non-Cycling Control Relay

Most systems are affected by leakage of refrigerant through the solenoid valve and also through the discharge valves of the compressor (from the high side of the compressor to the low side) when shut down. Because of this, the suction pressure in the compressor can rise to the cut-in setting of the low pressure element in the dual pressure control even though the thermostat in the conditioned space is satisfied. This will cause the compressor to start, run for a short time, and then stop, when the suction pressure is again reduced to the low limits of the dual pressure control. This cycling, unless corrected, will continue, and result in needless wear on the compressor and electrical equipment.

A non-cycling control relay can be used in the control circuit to prevent compressor operation until cooling is actually required. The relay coil is wired in parallel with solenoid valve coil and both are energized by the thermostat. The relay has one normally open contact that is in series with the compressor motor starter. Therefore, the circuit to the compressor motor starter is open, unless there is an actual demand from the conditioned space for cooling. The operation of the non-cycling control relay may best be understood by noting that it is

connected to the compressor starter in the same manner as the *start* button and that the low pressure cut-out is connected to act as the *stop* button. Thus the low pressure cut-out can stop the compressor but not start it, and the non-cycling relay may start the compressor but not stop it.

Capacity Control

In most comfort applications the actual load will fluctuate below the design load most of the time. Therefore, a control system that provides only for full capacity, or no capacity, does not satisfactorily meet part load requirements. Such a system starts and stops frequently in its attempts to satisfy the load in the conditioned space. This cycling results in high power consumption and accelerates wear on the equipment in the system.

In order to meet the requirements of part load operation it is necessary to control the balance point between the load and the refrigeration system capacity. This control normally takes place at the evaporator.

Even a compressor equipped with suction pressure actuated internal capacity control cannot vary its capacity appreciably unless the evaporator output is regulated. The reason for this is that a direct expansion cooling coil will maintain a high capacity as long as air at a relatively constant temperature is flowing over the coil, and, of course, the coil is supplied with refrigerant. In most comfort cooling installations, the air mixture flowing over the coil is at a relatively constant temperature with the normal ratio of return air and outside air. For this reason, it is necessary to either modulate the amount of air flowing over the evaporator or otherwise regulate the evaporator output.

Regulating the Evaporator

Evaporator capacity can be regulated through the use of a multi-circuit coil—each circuit with its own solenoid valve. A multi-stage thermostat should be used to control the solenoid valves.

Two-circuit evaporators are quite common and are normally controlled by a two-stage thermostat. This enables the system to balance at either full capacity, or at approximately one-half capacity.

In a two-circuit evaporator system—as the load in the conditioned space drops off—the two-stage thermostat closes one solenoid valve and thereby cuts out one-half of the evaporator capacity. This reduces the amount of refrigerant gas entering the compressor, and the suction pressure is lowered. The drop in suction pressure allows the compressor's unloader system to reduce the compressor's capacity by unloading some of the cylinders, thereby effecting a saving in power requirements.

Although the multi-circuit evaporator gives more satisfactory control than the all-or-nothing system, there is a more efficient method of meeting the wide variation of load in most systems.

Face-and-By-Pass Dampers

Face-and-by-pass dampers can be used to obtain a closer adjustment of cooling capacity. Face dampers are installed on the entering air side of the evaporator and divert a part of the return air around the evaporator. Since only a portion of the air is flowing over the cooling coil, the coil capacity is reduced and less refrigerant evaporates. The expansion valve then meters less refrigerant into the coil. Thus the suction pressure is decreased and the compressor unloads in response.

Werner George Wassmandorf, Manager of the Reciprocating Compressor and Cold Generator Sales Department of The Trane Company, came to Trane in 1952 after spending a number of years as a sales representative for Brunner Manufacturing Company and as a sales engineer for General Electric. He received his degree in mechanical engineering from the University of Michigan. Mr. Wassmandorf is also the author of several additional technical articles. Among these are the articles entitled, "Capacity Control For Compressors", and "Packaged Refrigeration Equipment for Artificial Ice Rinks", which appeared in AIR CONDITIONING, HEATING AND VENTILATING.

The return air diverted around the evaporator is moved through a by-pass duct containing by-pass dampers. The face-and-by-pass dampers are mechanically linked; therefore, when the face dampers begin closing to divert air around the evaporator, the by-pass dampers automatically open to allow the air to pass through the by-pass duct.

Both sets of dampers are positioned by a modulating motor, actuated by a modulating thermostat. Under part load conditions the thermostat will close the face dampers and open the by-pass dampers, both only partially.

In this system the solenoid valve is controlled by an auxiliary switch on the damper motor rather than a normal thermostat. The solenoid valve is then closed when the face dampers are closed, and open when the face dampers are partially or fully open.

Control Transformer

When the electrical power supply used in refrigeration and air conditioning systems exceeds 250 volts, a control transformer is necessary. This is required since the oil pressure safety switch and dual pressure control are designed for a maximum of 250 volt operation. Thus the voltage in the control circuit must be reduced to this rating, or lower. The reduced voltage is used for the dual pressure control, oil pressure safety switch, and for the pick-up and holding coils of the motor starters. Coils for these starters should be provided with a rated voltage of either 110 or 220 volts, whichever is delivered by the control transformer.

The solenoid valve and control relay receive their power from the fan motor circuit of the air conditioning unit. Therefore, their coils should be selected for the line voltage that is supplied to the fan motor except when this voltage is above 230 volts. Then, a control transformer must be used to reduce the voltage supplied to the solenoid valve and relay to 115 or 230 volts. This is necessary because solenoid valves are not normally made with coils for higher voltages. The thermostat, or auxiliary switch on the damper motor—whichever is used—should also be selected for this same voltage.

Optional Switches

Two optional switches can be added to the control circuit to make the system more versatile. These are the *Summer-Winter switch* and the *Manual-Off-Automatic* switch.

The *Summer-Winter* switch is wired in the circuit just ahead of the solenoid valve. When set at *Winter*, it breaks the circuit to the solenoid valve and the control relay. Thus the air conditioning unit fan motor can be run for air circulation during winter months without compressor operation. When set at *Summer*, the control circuit is complete and the entire system will function.

The *Manual-Off-Automatic* switch is located in the control circuit ahead of the dual pressure-oil pressure safety switch controls. When set at *Manual*, the compressor may be run for test purposes, without the necessity of operating the entire system. When set at *Automatic*, the complete system operates.

Compressor Wiring Diagrams

The series of eight wiring diagrams* illustrate single compressor installations, parallel compressor installationstions and duplex compressor installations.

The single compressor installation is one in which a single compressor, motor, dual pressure control and oil pressure safety switch are used. The parallel installation has two compressors, two motors, two dual pressure controls and two oil pressure safety switches. The duplex compressor installation has two compressors, one motor, two dual pressure controls and two oil pressure safety switches.

Motor Starters

There are four types of motor starters illustrated in the wiring diagrams. These are the across-the-line starter, the autotransformer reduced voltage starter, the primary resistance reduced voltage starter and the two-step part winding increment starter.

As the name implies, the across-the-line starter simply applies the full line voltage directly to the windings of the compressor motor.

The autotransformer starter reduces, by means of a transformer, the voltage applied to the compressor motor. This device permits a portion of the line voltage to enter the motor windings on starting and full voltage to be applied after a time delay.

The primary resistance type starter limits the initial voltage to the motor windings by connecting external resistance in series with the windings. After a time delay, this resistance is shorted out and full line voltage is applied to the motor.

The two-step part winding increment starter is used for motors with two windings. On the first step, full line voltage is connected to a portion of the winding, and after a time delay the starter connects line voltage to the remainder of the winding.

Since magnetic starters—with provisions for reducing the initial surge of current drawn from the line—are required by many power companies, it is well to consult the local power company before selecting a starter.

Cooling Tower Thermostat

When a cooling tower is used, it is often a good economy measure to insert a thermostat in the cooling tower fan circuit. The thermostat bulb is located in the condenser water line leaving the tower. On those days when the outside temperature alone is sufficient to lower the temperature of the cooling tower water to design conditions, this thermostat will prevent the cooling tower fan from operating. When outside temperatures are too high to give effective cooling to the water, the thermostat will allow the cooling tower fan to operate.

The Diagrams

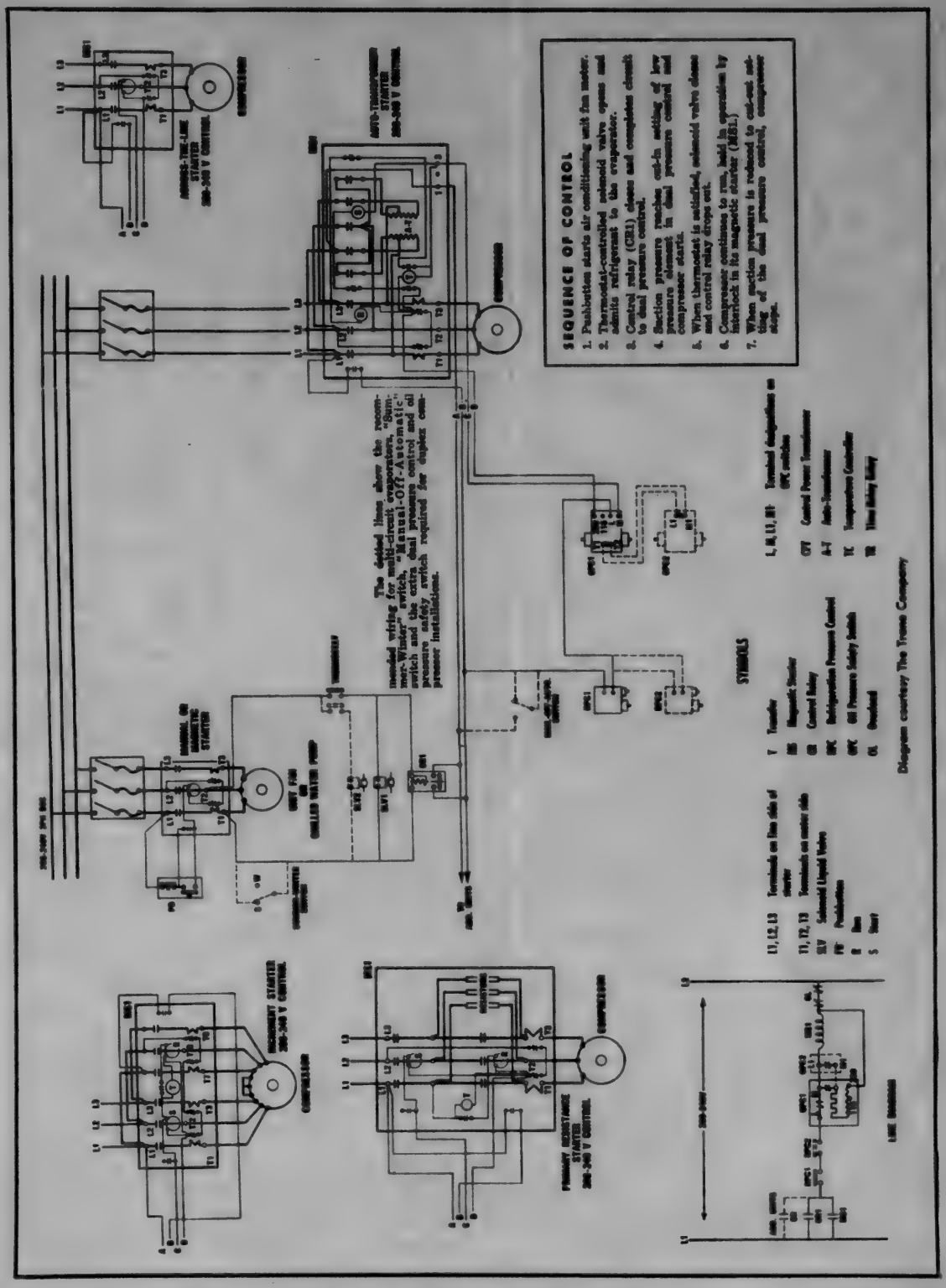
The wiring diagrams for single or duplex compressor installations with city or well water for condensing appear on the next two pages which constitute this month's Detail Sheets. The diagrams for single or duplex compressor installations with evaporative condenser or cooling tower will appear on next month's Detail Sheets. Parallel compressor installations for city or well water and evaporative condenser or cooling towers will appear in subsequent months, respectively.

* The wiring diagrams referred to in this article are eight in number and will appear in this, and subsequent issues, as follows:

Title	Published
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—1 Single or Duplex Compressor, City or Well Water for Condensing, 208-240 Volts	Detail Sheet — Page 79 This Issue
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—2 Single or Duplex Compressor, City or Well Water for Condensing, 380-550 Volts	Detail Sheet — Page 80 This Issue
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—3 Single or Duplex Compressor, Evaporative Condenser or Cooling Tower, 208-240 Volts	Front—December, 1959 Detail Sheet
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—4 Single or Duplex Compressor, Evaporative Condenser or Cooling Tower, 380-550 Volts	Back — December, 1959 Detail Sheet
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—5 Parallel Compressors, City or Well Water for Condensing, 208-240 Volts	Front — January, 1960 Detail Sheet
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—6 Parallel Compressors, City or Well Water for Condensing, 380-550 Volts	Back — January, 1960 Detail Sheet
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—7 Parallel Compressors, Evaporative Condenser or Cooling Tower, 208-240 Volts	Front — February, 1960 Detail Sheet
WIRING DIAGRAM—REFRIGERATION COMPRESSORS—8 Parallel Compressors, Evaporative Condenser or Cooling Tower, 380-550 Volts	Back — February, 1960 Detail Sheet

WIRING DIAGRAM—REFRIGERATION COMPRESSORS—1

Single or Duplex Compressor, City or Well Water for Condensing, 208-240 Volts

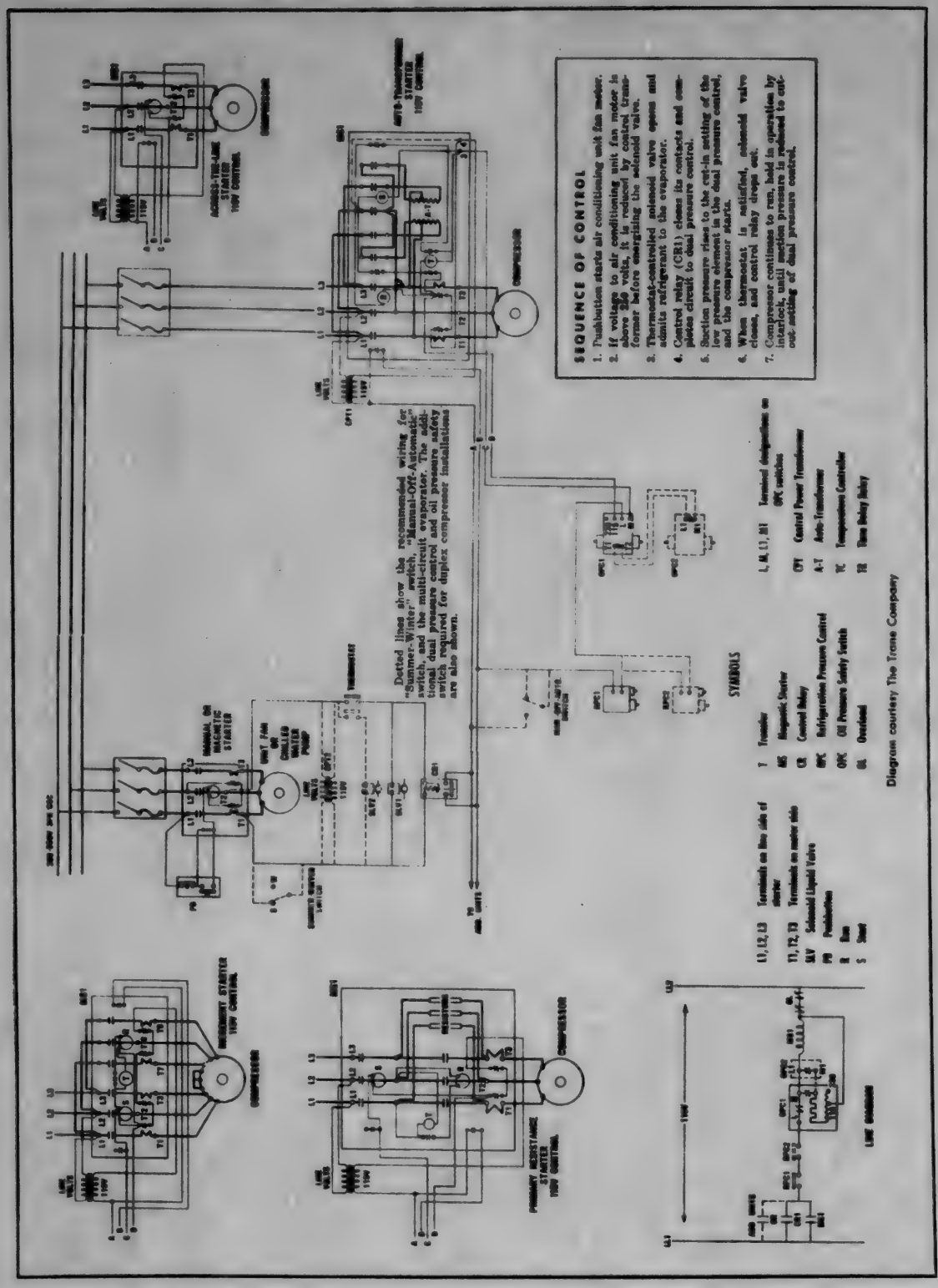

SEQUENCE OF CONTROL
1. Pushbutton starts air conditioning unit (no water).
2. Thermostat-controlled solenoid valve opens and admits refrigerant to the evaporator.
3. Control relay (CR1) closes and completes circuit to dual pressure control.
4. Suction pressure reaches cut-in setting of low pressure element in dual pressure control and compressor starts.
5. When thermostat is satisfied, solenoid valve closes and control relay drops out.
6. Compressor continues to run, held in operation by interlock in its magnetic starter (MS1).
7. When suction pressure is reduced to cut-out setting of the dual pressure control, compressor stops.
The dotted lines show the recommended wiring for multi-circuit operation, with Mer-Winter switch, "Manual-Off-Automatic" switch and the extra dual pressure control and oil pressure safety switch required for duplex compressor installation.
SYMBOLS
Diagram courtesy The Trane Company

DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

November, 1959

WIRING DIAGRAM—REFRIGERATION COMPRESSORS—2

Single or Duplex Compressor, City or Well Water for Condensing, 380-550 Volts


SEQUENCE OF CONTROL
1. Pushbutton starts air conditioning unit fan motor.
2. If voltage to air conditioning unit fan motor is above 380 volts, it is reduced by control transformer before energizing the solenoid valve.
3. Thermostat-controlled solenoid valve opens and admits refrigerant to the evaporator.
4. Control relay (CR1) closes its contacts and completes circuit to dual pressure control.
5. Suction pressure rises to the cut-in setting of the low pressure element in the dual pressure control, and the compressor starts.
6. When thermostat is satisfied, solenoid valve closes, and control relay drops out.
7. Compressor continues to run, held in operation by interlock, until suction pressure is reduced to cut-out setting of dual pressure control.
Dotted lines show the recommended wiring for "Summer-Winter" switch, "Manual-Off-Automatic" switch, and the multi-circuit evaporator. The additional dual pressure control and oil pressure safety switch required for duplex compressor installations are also shown.
SYMBOLS
T Transistor
MS Magnetic Starter
CR Control Relay
RPC Refrigeration Pressure Control
OPC Oil Pressure Safety Switch
OL Overload
L1, L2, L3 Terminals on line side of starter
T1, T2, T3 Terminals on motor side
SLV Solenoid Liquid Valve
PB Pushbutton
R Run
S Start
L, M, L1, M1 Terminal designations on OPC switches
CPT Control Power Transformer
A-T Auto-Transformer
TC Temperature Controller
TR Time Delay Relay
Diagram courtesy The Trane Company

DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

November, 1959

PRICING DATA FOR QUICK ESTIMATING

(Data courtesy of York Div., Borg-Warner Corp., York, Pa.)

The following cost data are based on 1957 price estimates. The reader must make the appropriate correction for price levels at the time of application.

Table 1—Refrigeration Pricing Table

Refrigeration System Range, Tons	Evaporator Temperature, deg F					
	50	40	30	20	0	−20
	Refrigeration System, Price per Ton Delivered and Erected					
2–9	$500	$600	$725	$900	$1300	$1900
10–49	375	425	550	675	900	1250
50–249	250	300	350	450	650	950
250 and over	125	150	175	275	425	600
	Complete Bill of Material, Price per Ton Delivered and Erected					
2–9	$775	$875	$1100	$1200	$1550	$2200
10–49	675	775	900	1000	1200	1650
50–249	675	725	825	925	1100	1400
250 and over	675	725	775	825	900	1200

Table 2—Air Conditioning Pricing Table

Water Cooling System Range, Tons	Type of Compressor		
	Packaged Reciprocating	Single-Stage Turbo	Multi-Stage Turbo
	Price per ton of air conditioning, delivered and erected, excluding items detailed in footnote.		
20–50	$160	....	....
50–100	125	....	....
100–200	110	$150	....
200–500	....	130	....
500–1000	....	....	$110
1000–2000	....	....	100

Price includes water cooling system as furnished by the manufacturer, set in place in ground-level engine room on foundation or pad furnished by others. Motor and starter included, with starter placed in engine room where separate from system. Price does *not* include cooling tower, pumps, water piping, insulation, or electric wiring.

Correction of Tables 1 and 2 For Methods of Condensing

1. City water through tubular condensers: No correction needed.

2. Well water through tubular condensers: Add cost of well and pump per local conditions.

3. Atmospheric air through economizers: Add $50 per ton of refrigeration for increased cost of economizer to figures in tables. Increase includes subcooling coil, fan motor and starter, cork pad, close duct discharge connections, additional freight and labor, but not air supply connections, structural supports, and electrical wiring.

4. Induced draft cooling tower water through tubular condensers: Add $60 per ton of refrigeration for tower mains, pumps, gages, thermometers, pump foundations, freight, cartage and labor, but not including rigging tower structural supports and electric wiring.

Definitions of Terms Used

Refrigeration system—includes high side and low side equipment, interconnecting mains and installation. *High side equipment* includes compressor, prime mover and controls, water cooled condenser, and receiver. *Low side equipment* includes water cooler, brine cooler, direct expansion conditioner or room piping. *Interconnecting mains* include refrigerant mains, insulation and refrigerant charge. *Installation* includes freight, cartage, rigging, and erection. *Economizers* are priced as an addition.

Auxiliary equipment—includes installed chilled water or brine mains with insulation and pumps, indirect coolers and heaters, sheet metal work, filters, fans, grilles, and controls. Also, the condensing water system with cooling tower, mains, and pumps.

Service facilities—include all service connections to apparatus, such as condenser water make-up and drain lines, steam and condensate lines, and electric wiring.

Building alterations—include concrete equipment foundations, steel supports, wood platforms and any other related building work for equipment supports. *Not included* are general contract work such as partitions, equipment penthouses, cutting, patching, or redecoration.

Complete bill of material includes the refrigeration system, auxiliary equipment, service facilities, and building alterations.

Supplementary Pricing

The prices listed in Table 1 for a complete bill of material can be built up for a particular project in the following manner:

First, select the price of the refrigeration system from Table 1. Second, add to the refrigeration system the allowances for auxiliary equipment, service facilities, and building alterations as outlined below:

1. *Auxiliary equipment:*

Fans

$.10 per cfm including motor, drive, and isolation (10,000 to 50,000 cfm).

Filters

Throw-away-filters, with frames, $.02 per cfm
Replaceable media, $.05 per cfm
Cleanable, with frames, $.07 per cfm
Roll-up, $.08 per cfm
Electrostatic (with cleanable filters) $.20 per cfm

Motors and Starters

$15 per hp for motors (25 to 500 hp)
$5 per hp for full voltage starters (25 to 500 hp)

Insulation

$.40 per board foot
Lagging for shells—$.80 per board foot
Lagging for pumps-$50 per pump

Duct Insulation

Glass board with vapor seal including application, seaming and banding-$.70 per sq ft

Sheet metal ductwork

Usually sold by the pound, erected in place. Costs will vary for different sections of the United States. The following are approximate cost figures:

0 to 5,000 lb	$1.00 per lb
5,001 to 10,000 lb	.80 per lb
10,001 to 15,000 lb	.75 per lb
15,001 to 20,000 lb	.70 per lb
20,001 to 25,000 lb	.65 per lb
25,001 to 30,000 lb	.60 per lb

2. *Service facilities*

Allow $25 cost per hp for electric wiring. All piping connections, including water, drain, steam, condensate, compressed air and brine piping, must be calculated and added.

3. *Structural steel supports*

Where structural steel equipment supports are to be estimated, use $230 cost per ton of steel. This is adequate for small sections such as angles, channels, 6-, 8-, 10-, and 12-inch beams. The weight can be figured from handbooks without trouble.

4. *Concrete*

Where concrete pump bases, concrete foundations, concrete piers, or wearing floors are to be included, estimate the cost at $80 per cu yd of concrete.

5. *Building construction*

Allow $0.75 per cu ft of room volume as cost. In addition, if insulation is required, allow $0.45 per board foot up to 4 inches; and $0.40 per board foot for 4 to 8 inches. These figures cover labor and material in normal building construction for warehouses, excepting elevators. The insulation covers cold storage doors.

Table 3—Ammonia Absorption Refrigeration Prices

	Evaporator Temperature, Deg F						
	−30	−20	−10	0	10	20	30
	Nominal Steam Pressure, Psig						
	105	85	60	45	30	20	15
	Approx. Steam Rate, Lb/Hr/Ton						
	44	40	35	32	28	27	25
Tons Refrig.	Price Per Ton of Refrigeration						
200	$440	$425	$415	$405	$380	$365	$350
400	305	290	285	280	275	260	250
800	255	240	230	225	220	215	205
1200	250	235	215	210	205	195	185
2000	230	220	210	205	200	190	180

Price includes evaporator (shell and tube brine cooler), piping, ammonia charge, erection and steel work. Insulation, freight, hauling and rigging is not included.

Based on circulating 5 gpm per ton of refrigeration of 85 deg F condensing water. Add or subtract $1.00 per ton of refrigeration for each degree increase or decrease of condensing water temperature.

Cooling Towers

Find costs from Fig. 1, then add the following for unloading, hauling, and hoisting:

Floors	*Price Per Ton*
1— 5	$ 65
6— 9	70
10—15	80
16—19	90
20—up	100

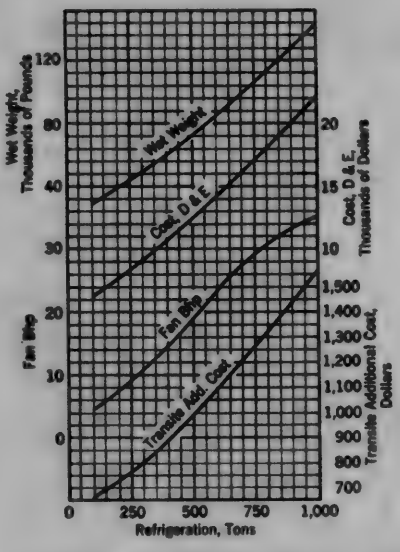


Fig. 1. Cooling tower costs, including motor and starter, based on 3 gpm per ton, 95-deg water in, 85-deg water out, and 78-deg wet bulb.

BRI: The Building Industry in 3-D

Milton C. Coon, Jr.

In the work and publications of Building Research Institute, the air conditioning, heating and ventilating engineer gives and receives from his collateral associates: architects, contractors, manufacturers, and realtors. Cutting across specialty lines, he sees present practices and future trends that affect his art with a new, three-dimensional realism.

Because of BRI's growing influence, the high quality of its publications, and its bigger-than-ever Fall Conference, scheduled this month, the editors have interviewed Milton C. Coon, Jr., the executive director, and Harold Horowitz, assistant director for technical programs, to find out just what's in it for ACH&V readers. The substance of the interview is reported.

Harold Horowitz

Q. Gentlemen, what is BRI? Is it a society, a trade association, or what?

A. BRI is a membership organization, which uses the techniques that you associate with the professional society to bring people together who are interested in building research and development, building problems and their solutions. These people would not normally get together through the regular channels that have already been established in the building field.

Q. With all the existing organizations in the building industry, why should we support another one?

A. The significance of BRI is only understood in relationship to the composition of what we call the building industry in the United States. The professional groups and the trade groups in the American building industry are very highly organized on specialized lines. For example, manufacturers of aggregates (they're used in concrete and plaster) are organized into associations by the different types of aggregates and sometimes, by the origin of the same type of aggregate.

This has its counterpart in every aspect of the building industry. There are development problems with heating and air conditioning equipment and systems that people concerned directly with the development of apparatus ought to discuss with, say, managers and operators of buildings. However, they don't get discussed in an organized way unless one of the manufacturers decides that he wants to send a man out into the field to talk to a few people, who own and operate buildings. If he does this, whatever he learns is his property. He's very careful about holding on to it. As a result, that kind of experience doesn't get exchanged in an open way.

Q. Then, the major function of BRI is to bring together various people from the building industry?

A. We feel that our main function is in the advancement of the science of building. To do this BRI acts as a sort of catalyst, bringing together within its membership and at its conferences all types of people in or associated with the building industry: architects, engineers, builders, contractors, realtors, etc., to help solve their common problems.

BRI does three things. First, it provides a forum in which the building industry can present and discuss its ideas. Secondly, areas for further research are delineated, and finally, information about building research and technology is collected, correlated, and distributed.

Q. How does BRI attempt to accomplish these three objectives?

A. The three broad purposes and objectives which we outlined before are served through our activities at conferences, of which we have several types, through committee meetings, round table discussions, and also through our publications.

Q. To be more specific, of what interest is BRI to the designer of air conditioning, heating and ventilating systems for commercial and industrial buildings? It is these engineers, whether they work for consulting engineers, architects, contractors, realtors, utilities, etc., that make up the bulk of ACH&V readership.

A. One main benefit is that the engineer can use BRI as a source of information on general trends in product development outside the heating field which will eventually have some impact on the design of equipment or the application problems that he's interested in. This is the sort of information that will keep him thinking in terms of what may happen in the next five years.

Q. How would he find this out?

A. First, through attendance at conferences and participation in the committees that develop programs and second, through our publications. Heating and air conditioning engineers have profited measurably by attendance at our conference on windows and glass in the exterior of buildings. Windows and glass, as they are developing, for use in the exterior of buildings, are having a strong impact on the design of air conditioning, heating and ventilating systems. We might also mention our conference on noise control in buildings. One way in which they can find out about these problems, without commercialism, is through attendance at a meeting of that kind, where the subject is attacked from all aspects.

Q. Who joins BRI?

A. Architects, engineers, manufacturers, contractors, distributors, building owners, home builders, technical and professional societies, research laboratories, financial firms, real estate firms, insurance firms, professional consultants, and technical experts from colleges, universities, and government agencies, both in this country and abroad. Also, officers of building trade associations.

Q. Do you have to be a member of BRI to participate in its program?

A. No. The main benefits accrue to members, of course. They participate in the work of the Institute and thereby have a direct effect on the shaping of its programs. In the process, you have a chance to work with the various groups of people that we have in the membership on a much more personal level than you could just at conferences. On the other hand, the nonmember is welcome to attend all of our conferences, and some of our publications are available to him.

Certain service publications are available to members only. This includes our *Building Science News*, which is a monthly, our *Abstracts of Building Science Publications*, a quarterly, and our Register of Members.

Another reason for joining BRI is that without the support of the members of the organization, BRI could not exist at all. That's a high-minded reason. Some people get it—and some people don't.

Q. If I can get the proceedings of the conferences, why should I attend?

A. From the standpoint of your engineers, it gives them a very good opportunity to sit around and actually talk with people whom they don't ordinarily meet, the kinds of people that own buildings, operate buildings, the architects, the people who manufacture ducts and what-not. They are all there. They break for a half-hour, right in the middle of the morning, for coffee. People go around talking to one another and make dates for lunch.

We don't schedule lunches. We don't hold any formal dinners. We have a reception and cocktail party where the people gather and meet one another and then go off in groups together to talk further over dinner. Our meetings particularly provide a good opportunity to meet the kind of people the engineer wants to meet and to discuss with them the things that are most important to him.

Reading about the results of the conference is not like being there. Most of our conferences are set up in such a way that there are forums and discussion periods immediately following the presentation of papers. If you're not there, the problem that you may have, or the point you may wish to make would not be raised.

Q. What publications of BRI are available to nonmembers? How may they obtain them?

A. Proceedings of all of BRI's conferences or meetings are published in book form, most with illustrations. These may be purchased from the Publications Office of the National Academy of Sciences in Washington.

A List of Publications is available from BRI at 2101 Constitution Avenue, Washington 25, D.C., listing the popular conference proceedings, study group and workshop reports.

Shown above are four periodicals furnished free to BRI members. Non-members may subscribe to the Directory, a "who knows what" compendium, revised quarterly, which details the research activities of organizations and societies in the United States, with names and addresses of their executives and their publications.

Q. I understand that the Fall Conferences of BRI, which you are holding here in Washington November 17 through 19, represent a departure in programming.

A. Yes. Up until now, we've had a number of conferences each year on individual subjects, as well as the Annual Meeting, which had a diversified technical program. Last year we had so many programs that our members were complaining that they could not attend them all. Starting this fall, we'll have two big meetings a year—one in the fall and one in the spring.

Q. What do you hope to accomplish by this new arrangement?

A. The period of three days each Spring and Fall in which the conferences will be held will actually include eighteen or more days of technical meetings in the form of simultaneous sessions. Even though it would be impossible, under this scheme, for one person to be present at all sessions, at least we will have an extremely diversified program being presented in the same location at the same time.

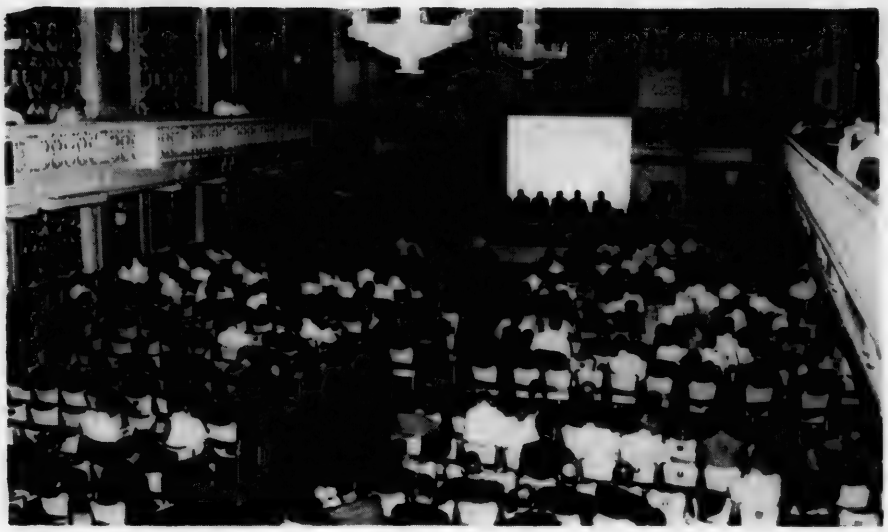
Q. Will the full day of sessions on new techniques of heating which is scheduled for the Fall Conference be the primary attraction to the heating engineer?

A. Probably not. The papers presented on new techniques of heating will most likely seem like old hat to anyone in the heating business. In this case the presentations are being directed to architects and contractors—both home builders and general contractors—building owners, managers, and operators.

Q. Not engineers?

A. Not really engineers. There will be engineers making the presentations, but the level of these particular

A portion of the group at BRI's 8th Annual Meeting at the Penn-Sheraton Hotel, Pittsburgh, in April.



presentations is such that they can be characterized as *the heating field* telling the rest of the *building field* what trends to anticipate as a result of work that has been done in the heating field.

Now, what the heating people and the heating engineers are going to learn is not so much about heating itself, but about the reactions and the response that the architects and the contractors, the owners and the operators, will have to this kind of information. It will give the engineer a chance to discuss this with them.

Q. In other words, as I understand it, the heating engineer is expected to learn most about heating in the American Society of Heating and Air-Conditioning Engineers, but will learn at BRI conferences just what the relationship between heating problems and other phases of building technology are.

A. Yes. An example in this fall's program is the three-day conference-workshop on sandwich panel design criteria. Now, we don't think there are very many heating engineers or heating contractors who have given too much thought to sandwich panels for use in walls, partitions, and roofs. Yet, this concept of structural design has been in the laboratories for fifteen years. There is beginning to accumulate a good deal of experience and data with prototype designs on sandwich panels and a very large number of people in the building field say that here is one of the important solutions to the problem of the sixties: How to achieve higher productivity with less labor at the building site.

Q. What would this mean to the heating people?

A. The thermal characteristics of sandwich panels are entirely different than other types of building construction. Good insulating value is one of the characteristics of the sandwich panel, but it is more complicated than that, because, for one thing, the mass of these panels is considerably less than that of traditional construction. You don't have the same kind of thermal lag factors. As a result we will need to have heating and cooling systems with much faster response. Furthermore, the problems of attachment are quite different. Attachment of heating equipment to the exterior walls, that is. The problem of penetrating the panel is quite different than attaching a piece of heating equipment to a masonry wall.

Q. That's going to affect where you run the ducts and pipes, isn't it?

A. Yes, the spaces in which you used to run ducts may not be there any more, because people are thinking about a prefabricated panel which will combine exterior weathering surface and interior finish. There's no space in there for ducts. They have to go some place else. So here's a chance to send technical people to be brought up to date in a two- or three-day period on the progress in the last fifteen years, so that in a few years, when they are suddenly called upon to provide systems for this kind of construction, and to make a satisfactory heating installation, it will not strike them as a bolt out of the blue.

Q. What is the difference between Building Research Institute and Building Research Advisory Board?

A. BRI is a membership organization, which, at the present time has somewhat better than four-hundred member units. This includes some giant corporations, with very large research staffs, and some two- or three-member firms, as well as individuals.

Since we consider every employee of a BRI member company as a member of BRI, our membership actually runs to several thousand people. Our program is developed in response to the interest shown by our members in specific subjects.

BRAB is a thirty-man appointed board which may stimulate and correlate research activities or study, on request, any subject of science or technology in its field and advise on questions submitted by any department or agency of the Federal Government or by industry or others when in the public interest.

Both BRI and BRAB are affiliated with the National Academy of Sciences-National Research Council through its Division of Engineering and Industrial Research. Each organization has its own executive director and pursues its own work. BRI and BRAB cooperate in many instances, but, as you see, their work is entirely different from ours.

Industry Must Train its Engineers

CHARLES J. BRILLINGER
Director of Training and Education, York Division,
Borg-Warner Corp., York, Pa.

New technologies present a challenge to industrial training and college curricula. The present engineering graduate is compared with earlier graduates. Company experiences and training objectives are covered.

THE engineering graduate entering the air conditioning and refrigeration industry today is different—when contrasted to his predecessor of as few as five to ten years ago. Chances are, too, that the difference will increase in degree—and we of industry will need to "roll with the punch." Suggested is a re-examination of our plans for assimilating this varying product of the college campus—or whether we can afford to be without a plan.

The past decade has well been termed as a period of exploding technology in a shrinking world. One impact has been sometimes frantic re-appraisals of curricula by engineering educators—even followed by crash programs of revision. On the whole, though, the changes have been orderly, are becoming identifiable, and are presenting a new challenge to industrial training. Essentially, "practicum" courses are being de-emphasized in favor of greater concentration upon and extension of theoretical aspects. Thus, attention to solid state physics, electronics, nucleonics, and heat transfer is *up*, while that given to surveying, drafting, manufacturing processes, and air conditioning system design is *down*. These changes are not sudden, but have been progressing for some years. The now recognizable impact represents a cumulative effect. These changes will continue, too, and that's not all.

Simultaneously, we've witnessed a refining of engineering curricula to take in more of the humanities and social sciences. This concept is education of the whole man in terms of widening horizons. The resultant understanding achieved constitutes a broad basic foundation for adaptation to a rapidly changing scientific and technological climate, as well as the absorption of increasing responsibilities in it. Once again, the inclusion of such subject matter is at the expense of courses which formerly developed competence in specific applications of technical knowledge.

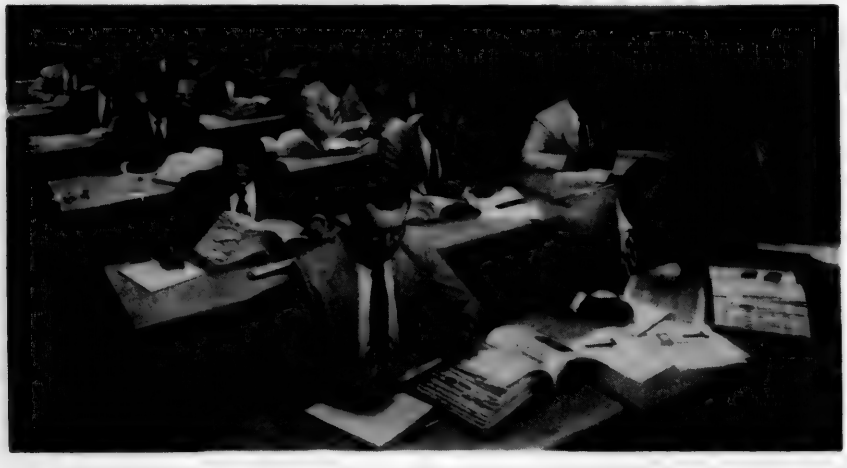
Industry Must Provide Training

These trends reflect the growing complexity of modern science and technology, plus recognition of the human values that may be affected. This is good! But we need to consider the widening gap which is developing between the graduating engineer and his effective utilization by industry. More and more, industry must assume responsibility for post-graduate training in details of current practice, specific engineering skills, and practical know-how. How well this training task is handled will determine the degree to which our engineering resources are fully developed—or engineering brain-power is finite.

Most of the larger firms in our industry are already doing this. It has long recognized that the expanding body of knowledge and related skills, which underlie our business, no longer permit haphazard trial-and-error learning. Rather, educational objectives have been set; training programs have been carefully planned to attain them; controls have been established over the progress of participants in these educational processes. Then, too, if these are to be successful, they must be designed and operated to develop more than knowledge and skill. Those precious intangibles such as pride, initiative, attitude, and even wisdom, should well be among the targets of a training plan.

Company Evaluation of the Graduate

To move from "Cloud 11" right down to cases, let us share with you impressions resulting from a decade of association with the selection and processing of personnel via the York graduate engineer training program. We use the term "training program" with some misgivings.



Graduate engineers at work in a classroom at York Institute, York, Pa. These men are taking an intensive training course sponsored by the York Division of Borg-Warner Corp.

It seems to infer a bit of magic, whereas, more than anything else, an effective program is but an organized series of situations to facilitate self-development. Realizing that introspection, as well as retrospection is involved, we would suggest that this year's composite graduate, in comparison with his earlier counterpart is:

More flexible in his viewpoints
More adaptable to varying assignments
Better self-disciplined
A better team-player
More enthusiastic
More concerned with the basis of current practice
More skilled in public speaking
Less effective in his use of the written word
Only slightly improved in personal effectiveness (based upon human relations skills). He is much more responsive to development activities along these lines, though less well-informed as to practical aspects of our industry
More educated from a theoretical standpoint
More concerned with the economics involved in engineering considerations

Certainly, these are generalizations, but are such as can be discerned, we believe, in the contrast and comparison of groups. For instance, nomenclature, or language of our business, calls for more explanations now than formerly. Likewise, more often than not, consideration of refrigeration system components is the end of the college instruction—without carry-over into the relationships that apply to their integration into systems. Likewise, basic psychrometry stops short of air conditioning factors such as diffusion range, air distribution principles, and standards of system performance. The algebraic assessment of the change gives us potentially a better product, if we of industry will accept our responsibility in the educational system for developing engineers that are truly educated and productive persons. It is a matter of working with colleges. Together, we assist the graduate engineer to realize his maximum potential. This calls for good selection, training, and placement.

Objective of Training

Industry training programs for graduate engineers are comprised of varying combinations of classroom and on-the-job training assignments—selected in relation to the planned placement of the student engineer. Our objectives are to develop his capabilities by:

1. Providing an orderly transition from school to industry.
2. Increasing and accelerating his effective utilization —so that he becomes productive early. This entails a "catching-up" in relation to prior technology of the industry.
3. Providing a better understanding of company operations, and so comprehend the relationship of engineering decisions with other phases, concepts, and functions.
4. Extending his knowledge and skills to deal effectively with increasingly complex engineering problems and human relationships.
5. To stimulate creativity by the use of problems calling for fresh and imaginative thinking, involving complex variables, and without stereotyped solution.
6. To provide impetus for continuing personal development.

Charles J. Brillinger, since 1949, director of training and education, York Div., Borg-Warner Corp., received a B.S. in industrial engineering from Pennsylvania State University. Following graduation, he joined York as a student engineer and from 1936 to 1943 he was business manager of the Engineering Division; he served as manufacturing-sales coordinator and then as supervisor of training for the next four years. He is responsible for the company's graduate engineer training program, factory training programs, and the recruiting of graduate engineers for York. Mr. Brillinger is a member of the American Society of Training Directors, American Society for Engineering Education; Mid-Atlantic College Placement Officers' Association and the Mid-Western College Placement Association.

Beyond the training program period lies the need to provide the proper managerial climate for the professional development of the engineer. This reminds us of a situation, several years ago, when our customarily good retention of graduate engineers seemed to slip. Investigation showed that the resulting losses were being incurred during the 12-month period following training program completion. A closer look revealed that the young engineer had moved from the training period, where he received rather close supervision, to an assigned department where he was likely "low man on the totem pole." Thus, in the press of daily urgencies, it was easy for the departmental manager to unconsciously give too little attention to this new member of the team. Needless to say, this situation quickly yielded to the corrective action of improved supervision.

A training program, well-organized and conducted, will provide motivation and encouragement to continued development—of personal capabilities in the years that follow. Thus, the achievement of professional stature seems to be a valid appraisal of a training program in industry. Further, our industry must provide the opportunity for this continuing training needed to exploit the ever-receding frontiers of science. We need to recognize that education is, in the words of William E. Wickenden, "not an episode in adolescence, but a life-time job."

What Becomes of the Student?

Here are the findings of a very recent survey of the retention and progress of a segment of the graduate engineers who pursued the York Training Program during the past decade. These statistics include only those who were interviewed and selected for careers in marketing—starting with the Class of 1949, and ending with the present small mid-year class employed in February, 1959. The overall retention is a gratifying 81.5%. Progress is depicted by this distribution of those presently employed:

Sales managers	12%
Sales engineers	54%
District representatives	3%
Sales staff supervisors	6%
Pre-sales engineers	13%
Employed by franchised sales outlets	12%

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Hot Water for Shower Facilities

LAST month's article on School Shower Facilities covered the different shower arrangements commonly used in modern shower rooms. In this article are covered factors that must be considered in furnishing an abundant supply of hot water for showers.

Water Distribution

There are three basic methods of water distribution for showers and these are shown in Fig. 1.

Method 1 distributes the water directly to the showers as shown. Both cold and hot water are discharged at the showers; control is either by individual valves or by a mixing valve at the shower. The arrangement using a mixing valve at the shower has been illustrated. With this method, the bather must regulate the temperature of water to his liking. There is a certain danger with this system in that, unless the hot water temperature is controlled at the source of generation, the hazard of scalding exists.

Method 2 is virtually the same as the first with the exception that a mixing valve is installed to regulate the temperature of the hot water being dispensed at the showers. Only cold and tempered water is furnished to the showers but individual mixing valves at each shower, permit the bather to regulate the water temperature to his liking without the danger of scalding.

Method 3 is a tempered water system. Here, the water temperatures are controlled by an operator at the mixing valve. Only a regular valve is placed at the shower itself to regulate the water flow.

All of the systems illustrated will function adequately when the piping distribution system is carefully designed and sized.

Tempered Water System

A tempered water system has application when it is desired to have an operator control and regulate the temperature of the water to the showers. For example, the operator will start the cycle with warm water and then increase the temperature for washing; finally he will supply cool water for rinsing. A typical arrangement of this system is shown in Fig. 2.

Although only a single piping system as would be utilized for a tempered water system is shown in Fig. 2, this system also serves to show how the hot water for a combination cold and tempered water system would be installed. The mixing valve controls and regulates the temperature of the water to the showers. Only one remote mixing valve has been indicated to handle both the boys' and girls' shower rooms. If desired, one mixing valve can be employed for each shower room. The mixing valve location is for example only, for the valve or valves may be placed at any specific location best suited for the installation.

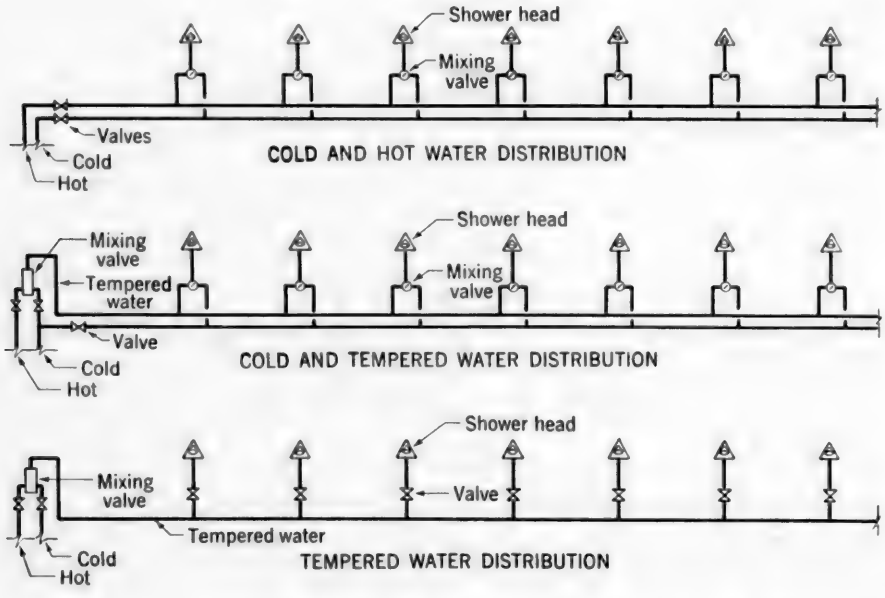


Fig. 1. Several basic methods of water distribution to serve the needs of water showers.

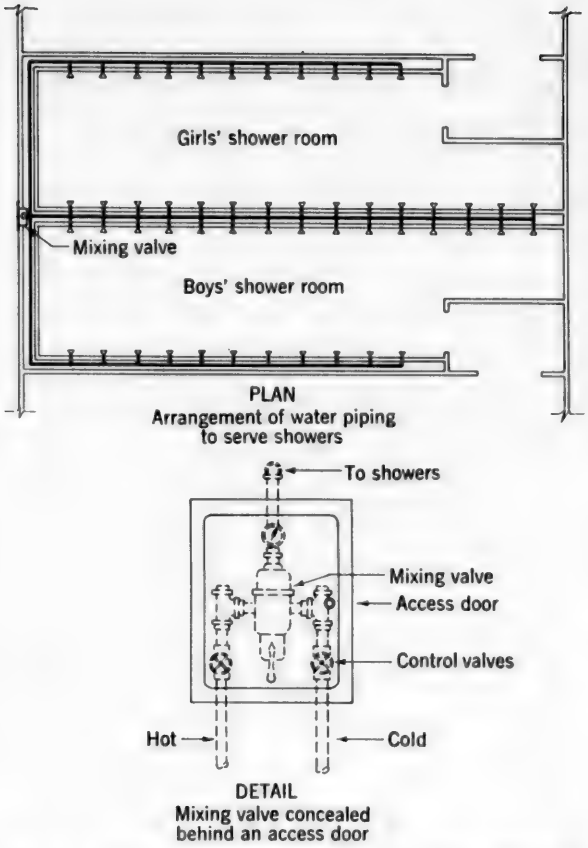


Fig. 2. An arrangement of a tempered water system to supply shower heads.

There are many mixing valve types available. The unit is generally placed behind an access cover that can be locked to prevent tampering. It is equipped with control valves, temperature gages, and other devices as required to render its adjustment and performance an easy task. When properly selected and installed, the mixing valve will supply the prescribed quantity of hot water to the showers with either a cold and tempered water distribution system, or a tempered water system. Consultation with the manufacturer of the particular valve favored is strongly recommended.

Hot Water Circulation

Since the shower facilities are often located some distance away from the source of hot water generation, it becomes necessary to provide a means of positive circulation of water to the showers. Two methods that can be used are suggested in Fig. 3.

The first method shown in Detail *A* of Fig. 3 is typical for systems where the hot water is furnished directly to the showers. Here the hot water feeds the showers and then, via the return line, is conveyed back to the hot water tank. This system permits hot water to circulate through the piping so that it is immediately available when the shower valve is opened.

Detail *B* shows how the hot water is circulated when a cold and tempered water system, or a tempered water system is used. The hot water is supplied to the mixing valve. A return line, connected to the end of the hot water supply main, conveys the water back to the tank. This method provides an instant supply of hot water for the mixing valves.

A well designed hot water circulation system will insure ease in regulating the proper water temperature at the mixing valve. Without a circulation system, one would have to wait until all the water in the hot water main was used before the actual hot water reached the mixing valve. A hot water main holds a considerable quantity of water; without a circulation system there is an appreciable waste of water. Furthermore, a certain hazard exists. Accurate temperatures cannot be regulated in a system without circulation before the hot water reaches the mixing valve.

Methods of Generating Hot Water

When showers are to be installed in a building, a considerable quantity of hot water must be generated and stored to handle the peak loads that occur at the end of each gym period.

The boys' and girls' shower rooms, shown in Fig. 2, each contain 26 individual showers. Showers can dispense 5 to 9 gpm or more. When metering devices are applied, the showers will dispense only 2½ to 4½ gpm.

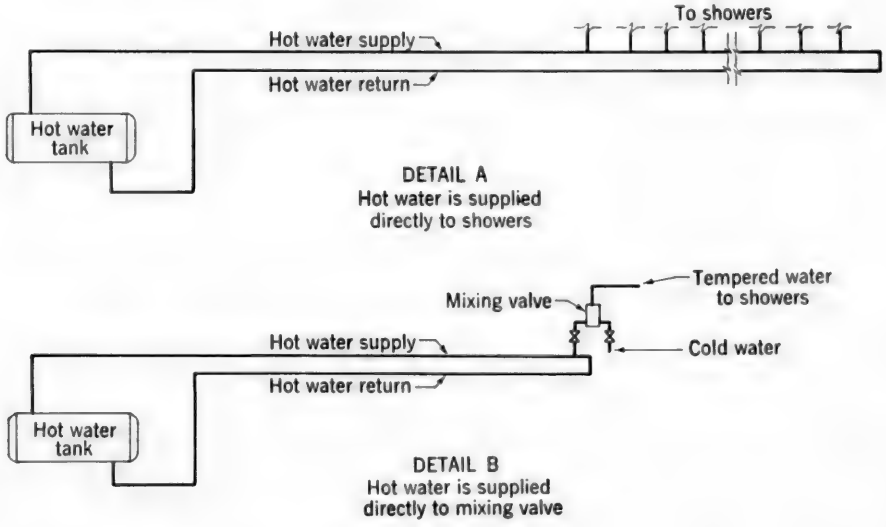


Fig. 3. Two methods of hot water distribution to shower piping arrangements.

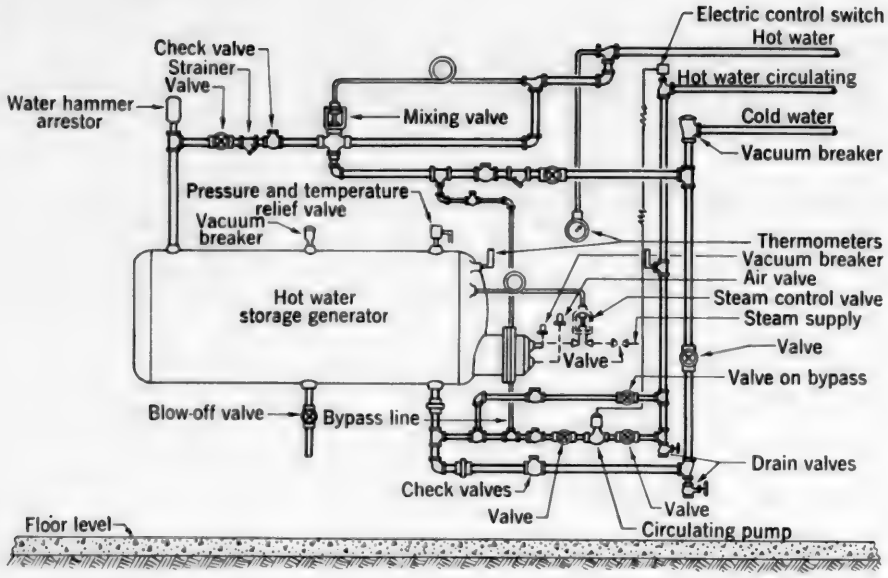


Fig. 4. Arrangement of a hot water storage generator and piping system to generate hot water for showers.

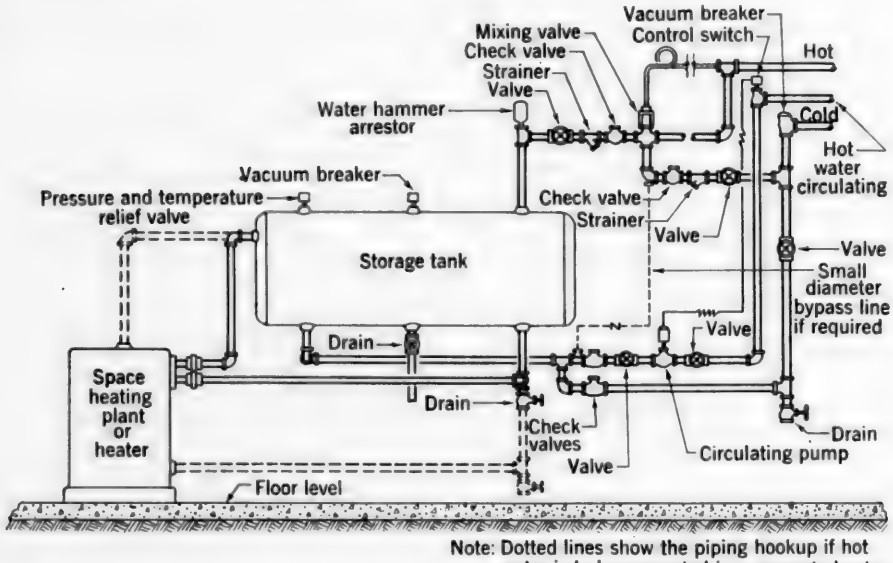
Using the maximum range of flow as in 5 to 9 gpm, the showers will dispense 2600 to 4680 gal in a 10-minute period, with all showers in use. If hot and cold water is mixed in equal proportions to produce a desired temperature, the hot water used will be 1300 to 2340 gal, which is a considerable load on the means of hot water generation.

Using the minimum condition, where metering devices are employed to regulate the flow of water at the showers, the flow of water for a range of 2½ to 4½ gpm per shower for a 10-minute period would be 1300 to 2340 gal. Again, assuming that equal quantities of cold and hot water are mixed, the hot water used would be 650 to 1170 gallons. It is easy to realize that the metering devices will conserve a considerable quantity of hot water and therefore will pay for themselves in a relatively short time.

Now to establish an average minimum flow of water so that we can relate it to our discussion, let us assume that with metering devices, 4 gpm will be dispensed at each shower. Since 52 showers are involved, we obtain a flow of 208 gpm with all showers running. Assuming that equal portions of cold and hot water are mixed, the flow of hot water for a 10-minute period would be 2080 gal. This means that the method of hot water generation must be capable of producing 2080 gal of hot water for each gym period.

Engineers may use other usage factors regarding the time when the showers are used, with 10 minutes as a maximum period. Even if the showering period is only 5 minutes, 1040 gallons of hot water must be made available. Therefore, considering that the range of showering will last between 5 and 10 minutes, approximately 1000 to 2000 gal of water must be produced for each period.

In these examples, it was indicated that the cold and



Note: Dotted lines show the piping hookup if hot water is to be generated in a seperate heater and not connected to the space heating plant

Fig. 5. Arrangement of space heater, storage heater and piping for the generation of hot water to serve showers.

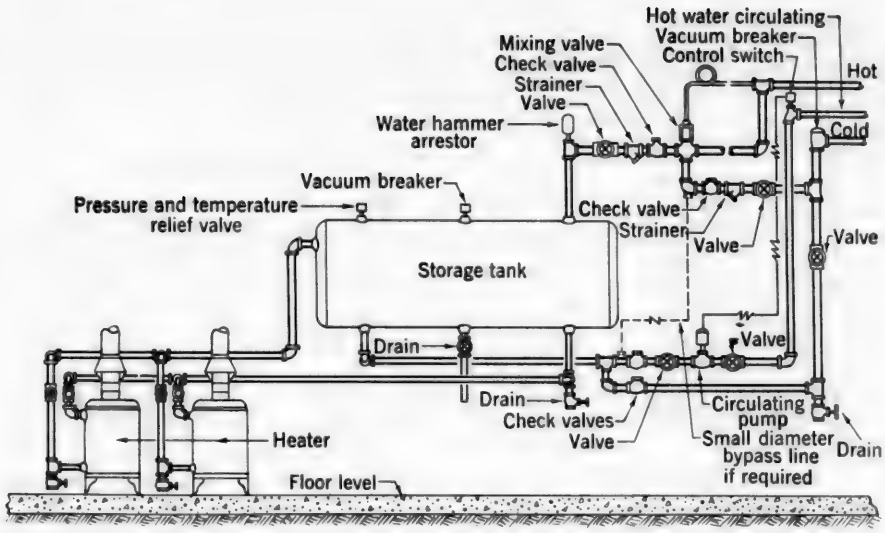


Fig. 6. A hookup of heaters and storage tank to supply hot water.

hot water were mixed in equal proportions to produce a desired temperature. Depending upon the temperature variations in the cold and hot water supply, larger amounts of hot water than cold water will generally be used to produce a desired temperature.

Hot Water Storage Generator

The hot water storage generator is by far the most popular method for generating hot water for showers because the hot water can be produced quickly and efficiently. This method of generation is illustrated in Fig. 4.

Steam is used for heating the water. The tank is sized to hold the water reserve available for immediate use; steam coils in the tank provide the desired recovery rate.

The piping arrangement shown is but a suggestion. The small diameter bypass line is a protective arrangement in the event that the hot water port in the mixing valve closes as a result of excessive high water temperatures in the storage tank.

For large shower rooms it is often advisable to furnish a separate hot water storage generator for the general hot water needs in the school and a separate unit for the shower facilities. Frequently, when the need exists, a more abundant supply of hot water can be obtained from the storage generator by increasing the temperature of the water stored. Thus, less hot water is required for mixing with the cold water to achieve a desired water temperature.

When carefully designed and installed, a system utilizing a hot water storage generator can be counted upon to provide many years of dependable service and will supply abundant quantities of hot water.

Hot Water Heaters

Another method that can be used for generating hot water involves the use of the space heating plant or a separate heater, as shown in Fig. 5.

In this instance, a hot water storage tank is used and the hot water is generated by the space heating plant or by a separate heater. For 1000 to 2000 gal of hot water, it is rather difficult to use the space heating plant for hot water generation unless this plant has been adequately sized for the purpose. When this method is used, piping connections to the storage tank would be similar to that denoted by the solid piping lines in Fig. 5.

Often, a separate heater is used and the piping connections would be similar to that shown by the dotted lines Fig. 5. A circulating pump can be added to either system as required. The separate heater will utilize oil, gas or coal as the medium generating hot water. This method is also efficient but it is important that the heater and storage tank be amply sized to furnish the hot water needed each period for shower facilities. Sometimes, it is advisable to oversize the storage tank to compensate for the lack of recovery that the heater can offer.

Gas Heaters

Another method of generating hot water involves the use of gas heaters as shown in Fig 6. For this arrangement it becomes necessary to provide a storage tank and two or more gas heaters to generate hot water. Gas heaters used for this purpose are generally not large enough for large deliveries of hot water. Therefore, it is necessary to oversize the storage tank to compensate for this slow recovery. To furnish 1000 to 2000 gallons of hot water for each period, 4 to 6 heaters would be

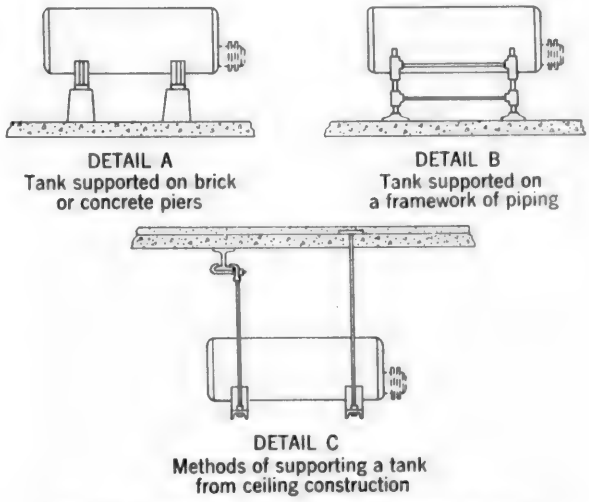

DETAIL A
Tank supported on brick or concrete piers
DETAIL B
Tank supported on a framework of piping
DETAIL C
Methods of supporting a tank from ceiling construction

Fig. 7. Methods of supporting hot water tanks.

needed dependant upon the particular design of the system and the size of the storage tank. It is a very good policy to consult with the manufacturer of the heater selected to benefit from his recommendations on the most favorable arrangements possible.

There are also other methods, including the use of electrical power, that can be utilized to generate the quantity of hot water needed for the school shower facilities.

Support of Storage Tanks

Storage tanks, whether they be hot water storage generators or just storage tanks should be properly supported. Figure 7 shows some of the methods used.

Detail *A* of Fig. 7 shows a tank supported on a cradle, which in turn rests on brick or concrete piers. This is an excellent way of supporting the tank but it is important to advise the foundation engineer of the total weight of the tank when it is filled with water. He then will provide a floor slab or necessary footing that can carry this weight.

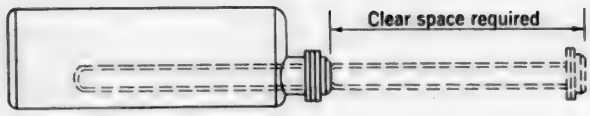
Detail *B* shows a tank supported on a framework of piping. Here again, the same consideration applies regarding the adequacy of the floor slab.

Detail *C* illustrates a tank supported from the ceiling where it is desired to elevate the tank, out of the way of other equipment on the floor. For this installation, it is extremely important that the ceiling construction and the method of attachment be carefully handled to ensure a safe installation.

Figure 8 shows the clear space that must be provided when a hot water storage generator is used. A clear space must be provided to permit the removal of coils. A well designed system includes ample access space for necessary servicing.

Types of Tanks

Since a large capacity storage tank is needed for storing the required quantity of hot water for shower facilities, some attention must be directed to the type of tank used.



Clear space required for removing heating coils contained in a hot water storage generator

Fig. 8. Space required for removing heating coils from a storage generator.

Two tanks, one mounted above the other, may be used in place of one tank of large capacity. The two tanks offer flexibility in that one tank can be used while the other is being serviced. Also, in the event of a leak, it is easier to replace one tank while the other carries the load. With one large tank, the system must be shut down while the tank is being repaired. The possible use of two tanks should be carefully considered.

When space is at a premium, the engineer may have to consider a vertical tank. Here again, it is good practice to consult with the tank manufacturer for his recommendations.

Summary

When you next design the water distribution system for the shower facilities in a school, keep these three factors in mind.

1. Design your system so there is no danger of scalding.
2. Consider metering devices to avoid the waste of water.
3. Provide an adequate storage of hot water.

When these means are given proper attention, the facilities will function properly.

Human Failure Reported Major Cause of Boiler Failure

The teaming up of boiler manufacturers with the insurance companies in a cooperative volunteer program of education for boiler operators has been advocated by Patrick D. Goggin, chief engineer of Boiler Engineering & Supply Co., Inc., Phoenixville, Pa. "In dramatic statistics assembled by The Hartford Steam Boiler Inspection and Insurance Company for its publication, *The Locomotive*," Mr. Goggin said, "the preponderant cause of boiler failures has been traced to human failure. This represents a fertile area for intensive educational promotion."

By actual tabulation, 85.2% of 1715 steel firetube boiler failures were traced to the neglect, carelessness, indifference, or ignorance on the part of the boiler operator. Over half of the failures were reported as failure to test and maintain control devices:

Test and maintain control devices	53.0%
Maintain water level	13.8%
Failure to clean	12.2%
Maintenance of auxiliaries (improper blowdown, freezing and miscellaneous neglect)	6.2%
Total attributed to human failure	85.2%
Defects developing during operation	6.2%
Improper design and construction	2.0%
Improper installation	1.6%
Miscellaneous	5.0%
	100.0%

"The growing popularity of the automatic package firetube boiler in institutional and commercial applications, and even in smaller industrial applications, where trained boiler operators are not normally available," Goggin stated, "probably helps to explain the large proportion of diagnoses as failure to maintain and test the controls systems."

"The most important part of a boiler startup," he emphasized, "is that phase concerned with the proper indoctrination and instruction of the man responsible for the care and maintenance of the boiler. This problem of operator instruction cannot be treated lightly without the severe risk of incurring later customer dissatisfaction. Changes and turnover of boiler operating personnel make the problem doubly frustrating. We have been constantly and continuously working toward the better education of the boiler operator."

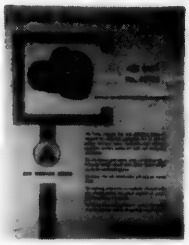
NEW LITERATURE

Use the prepaid postcard on last page for securing your copies of these catalogs.

Copper Tube Fittings

A copper tube fitting line catalog, containing useful information on the making of solder joints and flared connections, is available from Chase Brass & Copper Co., Waterbury, Conn. Included in 44-page catalog are flow capacities and friction loss allowances for tube and fittings.

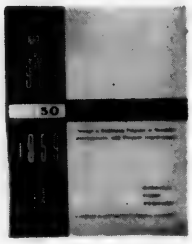
Circle **Item 1** on Inquiry Card



Small Centrifugal Blower

A 2-page illustrated bulletin, describing the American Blower centrifugal air unit No. 89C21 for electronic equipment cooling, is available from American-Standard Industrial Division, Detroit, Mich. Bulletin 5812 gives principal features, recommended applications and performance data.

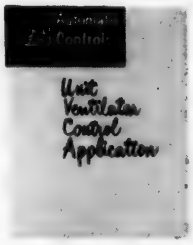
Circle **Item 2** on Inquiry Card



Building and Sewage Pumps

In commemoration of its 50th anniversary celebration, Chicago Pump Co., Chicago, Ill., offers an 8-page brochure. It depicts new products, systems and equipment applied to the field of sewage and industrial waste treatment; also, many types of building and sewage pumps.

Circle **Item 3** on Inquiry Card



Unit Ventilator Control

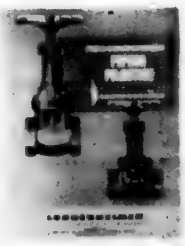
Its complete line of automatic control systems for unit ventilators is described in the Unit Ventilator Control Application Manual, published by Barber-Colman Co., Rockford, Ill. Actual control applications cover all makes and models marketed by major unit ventilator manufacturers.

Circle **Item 4** on Inquiry Card

Axial-Flow Elbow Fans

Axial-flow elbow fans are described in 4-page Bulletin VEF-59 from L. J. Wing Mfg. Co., Linden, N. J. It contains selection data for Wingfoil elbow fans, used for handling clean, contaminated, or explosive air or fumes at normal or elevated temperatures.

Circle **Item 5** on Inquiry Card



Recommended Piping Practice

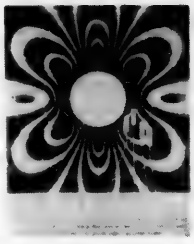
A handy wall chart, entitled Recommended Piping Practice, is published by Lunkenheimer Co., Cincinnati, Ohio. The three-color, 17 by 22 inch chart is described as being useful for installation and maintenance personnel, and for individuals requisitioning valves of all types.

Circle **Item 6** on Inquiry Card

Packaged Automatic Boilers

A new bulletin on the company's line of Powermaster Model 3 packaged automatic boilers is offered by Orr & Sembower, Inc., Reading, Pa. The colorful 12-page bulletin describes steam and hot water boiler types, includes ratings and dimensions, and discusses O & S burners.

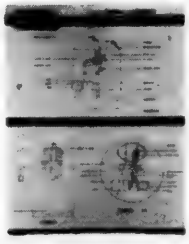
Circle **Item 7** on Inquiry Card



Electric Typewriter for Engineers

A method of using an electric typewriter for quick, convenient typing of special symbols and equations needed in the field of engineering is the subject of Booklet R-8964.6, published by Remington Rand, div. of Sperry Rand Corp., New York, N. Y. Interchangeable typewriter type is the key.

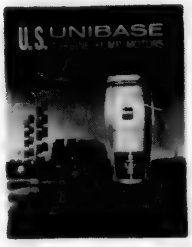
Circle **Item 8** on Inquiry Card



Swimming Pool Filters

Modern Swimming Pool Co., Inc., White Plains, N. Y., offers an 8-page booklet on installation and operation of its one-cell pressure filters, covering both above-ground and below-ground models. Includes pipe sizes, sand and gravel requirements, and filtration rates.

Circle **Item 9** on Inquiry Card



Turbine Pump Motors

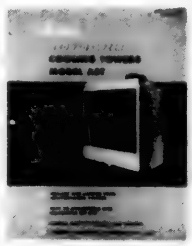
A brochure describing its Unibase turbine pump motors, with Microset coupling, is announced by U. S. Electrical Motors Inc., Los Angeles, Calif. Brochure features cross-section of Unibase motor, called the "first vertical pump motor designed for short-coupled industrial pumping service."

Circle **Item 10** on Inquiry Card

Submersible Integral Motors

A 4-page folder, published by Franklin Electric Co., Inc., Bluffton, Ind., includes description and availability data for the company's submersible integral motors. Modular design permits "stacking" of submersible motors to provide tandem units ranging through 40 hp.

Circle **Item 11** on Inquiry Card



Cooling Towers

A 4-page bulletin, No. 362, describes the Econ-O-Mizer cooling towers, designated Model AST, produced by Acme Industries, Inc., Jackson, Mich. These towers are reduced in size and weight by 50% compared to conventional towers. Bulletin gives construction, capacity and design data.

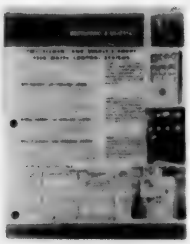
Circle **Item 12** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.

Integral Finned Tube

A 4-page bulletin describing Trufin integral finned tube is available from Wolverine Tube Div., Calumet & Hecla, Inc., Allen Park, Mich. Various types of the finned tubing are illustrated, and specifications include available alloys, plain and finned section dimensions, surface area ratio.

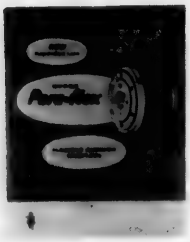
Circle **Item 13** on Inquiry Card



Feed Water Control

Two-element and single-element air-operated feed water control systems are described in 4-page Bulletin 531, published by Bailey Meter Co., Cleveland, Ohio. To aid in the selection of the proper system for each application, a simplified chart is included.

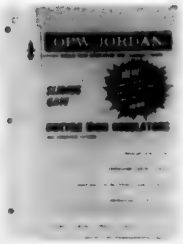
Circle **Item 14** on Inquiry Card



Flexible Cushion Couplings

An expanded line of Para-flex flexible cushion couplings, ranging from fractional to 190 hp per 100 rpm, is described in a 12-page bulletin from Dodge Manufacturing Corp., Mishawaka, Ind. Detailed selection tables of horsepower ratings, dimensions, and service factors are included.

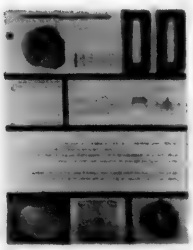
Circle **Item 15** on Inquiry Card



Ductile Iron Regulators

A 4-page bulletin, J-DI, on ductile iron regulators and control valves is available from OPW-Jordan, Cincinnati, Ohio. Bulletin is also a condensed catalog, and fully illustrates all sliding gate and plate regulators and control valves now available in ductile iron.

Circle **Item 16** on Inquiry Card



Direct-Drive Blowers

Complete dimensional and performance specifications on two series of direct-drive blower units, with either Center Lock or standard double Airotor wheels, are given in two new 4-page technical bulletins by Air Impeller Div., The Torrington Manufacturing Co., Torrington, Conn.

Circle **Item 17** on Inquiry Card

Electric Hot Water Heating Boiler

A 4-page bulletin describing its modern electric hot water heating boiler is available from Precision Parts Corp., Nashville, Tenn. For twenty-nine models, the bulletin provides number and capacity of heating elements, Btu per hr capacity, and sq ft radiation.

Circle **Item 18** on Inquiry Card

Hot Water Baseboard Heating

A 70-page design handbook, covering all aspects of zone-controlled hot water baseboard heating, is offered by Edwards Engineering Corp., Pompton Plains, N. J. Included are sections on design, layout, installation, and specifications; also, a detailed section on air conditioning.

Circle **Item 19** on Inquiry Card

Vibration Mounts

Hamilton Kent Manufacturing Co., Kent, Ohio, announces a revised edition of a brochure on its Rexon vibration mounts, devices employing the principle of "rubber-in-shear" to provide vibration isolation and acoustics control. Performance data and installation information are included.

Circle **Item 20** on Inquiry Card

Self-Cleaning Pipeline Strainer

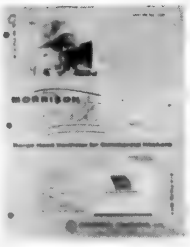
Bulletin 1210-1, published by Sarco Co., Inc., New York, N. Y., describes a new addition to the company's line of self-cleaning pipeline strainers in sizes from ¼ through 3 inches. The 2-page bulletin includes construction features, dimensions and weights, and screen information.

Circle **Item 21** on Inquiry Card

Mechanical Dust Collectors

Recent improvements in mechanical dust collectors are described in a technical bulletin published by Research-Cottrell, Inc., Bound Brook, N. J. Bulletin 300 contains detailed drawings and application diagrams about a new involute design and a new hopper discharge valve.

Circle **Item 22** on Inquiry Card



Commercial Kitchen Ventilation

Eight-page Catalog 1201, from Morrison Products, Inc., Cleveland, Ohio, describes its Filtaire line of packaged range hood ventilators for commercial kitchens. It details procedure for engineering these installations, including how to determine hood design and required air delivery.

Circle **Item 23** on Inquiry Card

Turbine-Type Pumps

An 8-page bulletin, No. S-111, illustrates and describes features incorporated in the new design of Apco turbine-type pumps by Aurora Pump Div., The New York Air Brake Co., Aurora, Ill. Also included are selection tables, limitation charts, dimensions, and construction specifications.

Circle **Item 24** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of these catalogs.

Gas Air Conditioner

Day & Night Manufacturing Co., La Puente, Calif., offers a brochure describing its recently introduced gas air conditioner, the Oasis. The 6-page bulletin presents product information and specifications, operating principles, and diagrams showing various methods of installation.

Circle **Item 25** on Inquiry Card

Group Showers

An 8-page bulletin describing and illustrating the company's multi-person type showers is available from Bradley Washfountain Co., Milwaukee, Wis. All details of the basic shower column, in three heights, are given, along with method of installation and floor plan suggestions.

Circle **Item 26** on Inquiry Card

Electric Radiant Heaters

A catalog with technical and descriptive information on its full line of baseboard, wall panel and ceiling-recessed glass electric radiant heaters is available from Berko Electric Mfg. Corp., Queens Village, N. Y. Equipment is applicable to homes, churches, offices and stores.

Circle **Item 27** on Inquiry Card

Steam Trap Primer

Barnes & Jones, Inc., Newtonville, Mass., announces its Steam Trap Primer, a 16-page booklet presenting facts about condensate drainage and steam trap function. Topics include where steam traps are used, operating principles of various types, determination of capacities, and maintenance.

Circle **Item 28** on Inquiry Card

Water Treatment Catalog

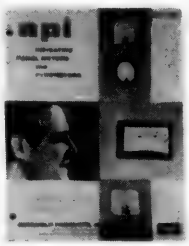
A comprehensive water treatment catalog is published by Calgon Co., div. of Hagan Chemicals & Controls, Inc., Pittsburgh, Pa. Brochure includes such products as Micromet crystals, which prevent corrosion problems, and a complete line of domestic, commercial and industrial Micromet feeders.

Circle **Item 29** on Inquiry Card

Industrial Fans

Fundamental data relating to capacities and construction of the Lehigh Type I. E. industrial fans are presented in 28-page Bulletin L-5 by Lehigh Fan & Blower Div., Fuller Co., Catasauqua, Pa. Included are complete rating tables and principles of good ducting practice.

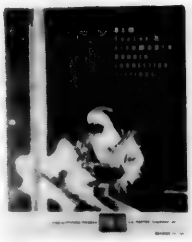
Circle **Item 30** on Inquiry Card



All-Purpose Panel Meters

Indicating panel meters and pyrometers in numerous sensitivities, styles and sizes, for monitoring any electrically measurable variable, are described in 12-page Bulletin 107 from Assembly Products, Inc., Chesterland, Ohio. Bulletin lists specifications, and groups meters by case types.

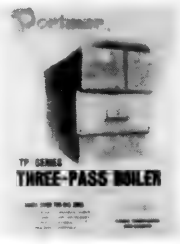
Circle **Item 31** on Inquiry Card



Branch Connection Fittings

Forge and Fittings Div., H. K. Porter Co., Inc., Roselle, N. J., offers a catalog covering its new and complete line of branch connection fittings. The catalog, TF-1-59, describes and illustrates the new TeeLets, and the new Fishmouths. All pertinent design information is included.

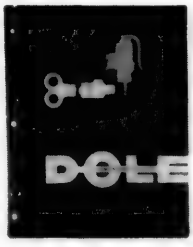
Circle **Item 32** on Inquiry Card



Three-Pass Boiler

Portmar Boiler Co., Inc., Brooklyn, N. Y., has issued a 4-page descriptive bulletin on its Series TP three-pass steel heating boiler for today's large structures. For sixteen oil, gas, or stoker-fired sizes, the illustrated bulletin provides dimensions and capacity ratings.

Circle **Item 33** on Inquiry Card



Plumbing and Heating Valves

A general valve catalog covering its full line of plumbing and heating products is announced by The Dole Valve Co., Morton Grove, Ill. The catalog covers flow controls, water mixers, vent valves and temperature and pressure relief valves, and gives typical applications.

Circle **Item 34** on Inquiry Card

Steel Tubing

A 4-page technical bulletin describing Smoothweld steel tubing is available from The Standard Tube Co., Detroit, Mich. Bulletin discusses application of steel tubing systems to replace screwed or welded piping. Tubing is soldered or silver brazed without need of separate couplings.

Circle **Item 35** on Inquiry Card

Pipe Coils and Fin Coils

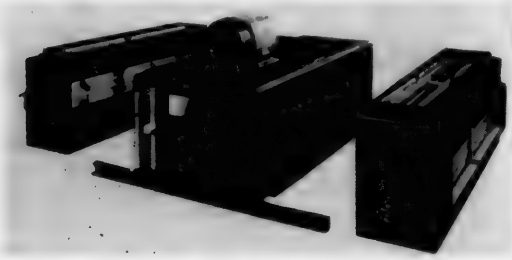
A 48-page engineering manual is compiled for the purpose of presenting design and calculation data on heating and cooling surfaces for use in all commercial and industrial applications of pipe coils and fin coils. It is available upon letterhead request to Rempe Company, 358 North Sacramento Blvd., Chicago 12, Ill.

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on the last page for securing additional information about new equipment and materials described in this department.

Blower Type Condenser

A blower type air-cooled condensing unit which utilizes rejected condenser heat for heating and ventilating is announced by McQuay, Inc., Minneapolis, Minn. Designated AL Aircon, unit combines refrigerant condensing with heating and ventilating and is said to be extremely flexible for indoor and outdoor use. It can also be used for the secondary purpose of exhaust ventilation and/or heating and ventilating.



Compactly designed and with attractive appearance, condensing unit can be ceiling, platform or floor mounted with a minimum of space required. With low silhouette it does not detract from the appearance of a building when roof mounted. Seven models are available in eight different unit arrangements with capacities from 10 to 50 tons.

More information? Circle Item 36, postcard, last page.

Complete Highside Unit

Kramer Trenton Co., Trenton, N. J., announces the availability of its Unicon-Compressor, a complete air conditioning highside, factory assembled, tested and run-in unit, designed for outdoor installation.

Fully protected from the weather, it can be readily installed on the roof, ground or any place where there

is ample supply of air. The complete highside is shipped ready to operate, requiring only an electrical supply and a few simple connections between it and the evaporator. Factory testing eliminates costly field problems.

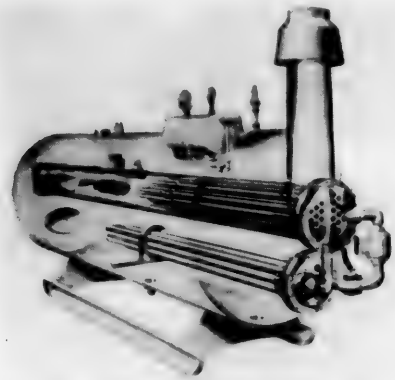
Since the opening of the access panel will cause the air to bypass the condensing coil, it is impossible to obtain true system operating conditions with the access panel open. To overcome this problem, the unit has all standard servicing components accessible on the outside. This includes electrical controls, pressure gage valves for suction and discharge, receiver inlet and outlet valves, purge valve and liquid sight glass.

More information? Circle Item 37, postcard, last page.

Indirect, Gas-Fired Storage Heater

The Patterson-Kelley Co., Inc., East Stroudsburg, Pa., announces development of an indirect, gas-fired storage water heater with a specially-designed "localized" combustion unit and a fluid-to-fluid intermediate heat transfer system for scale-free heating at efficiency approaching theoretical maximum.

The unit—a true storage heater combining indirect firing and large-volume heating of service water—is a completely self-contained package, including electronic controls for safe, quiet automatic operation without need of week-to-week or even month-to-month inspection or attention.



Basically, the self-contained Scalefree heater consists of three closely-integrated systems: (1) the gas burner or "furnace" part of the heater; (2) the forced-circulation heat transfer fluid system made up of the fire-tube element, the hot water heating bundle, and their interconnecting piping; and (3) the shell section which provides for heating, storing, and precise temperature control of service water.

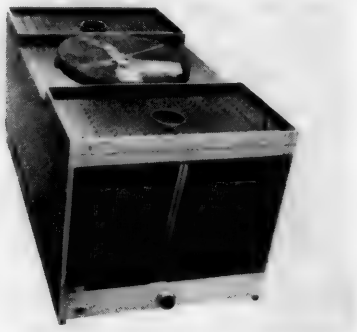
Scarcely audible in operation because combustion gases are fired gradually by the unusual design of the burner, the indirect-immersion type heater eliminates the high noise levels of conventionally-fired heaters, and can be located near offices or in areas where maximum quietness is required, according to the company.

The heater operates with any type of manufactured or natural gas. Simple adjustments can be made in the field to suit economical or geographical fuel conditions, or to permit use of boiler water for hot water heating during the winter months and re-conversion to gas for the summer water heating load.

More information? Circle Item 38, postcard, last page.

150-Ton Cooling Tower

The largest unit in the Halstead & Mitchell line of cooling towers, a 150-ton vertical discharge unit, is now available in standard production, according to the Zelienople, Pa., firm. Like all the company's towers, the EC-150 features a 20-year guarantee on the wetted deck surface against failures due to attack by fungus or rotting.



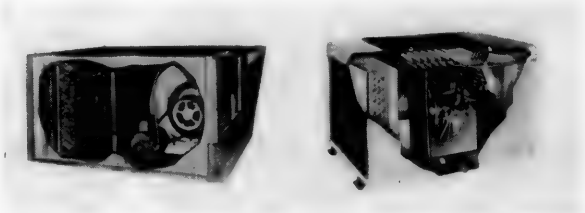
Made in special weatherized cabinets, the cooling towers are designed with a compact, low silhouette. Overall height is under nine feet. The EC-150 is made only in 10-gage design; this provides a tower of maximum rigidity, strength and durability.

Low speed, large diameter fans provide exceptionally quiet operation, the company reports. Air inlets are at both ends, and this insures efficient cooling of the circulating waters.

More information? Circle Item 39, postcard, last page.

Remote Air-to-Air Heat Pump

Mueller Climatrol, Div. of Worthington Corp., Milwaukee, Wis., announces a new remote air-to-air heat pump in 3- and 5-hp models. It consists of a remote outdoor compressor assembly, Type 318, at right in photo, and an indoor coil and air handling unit, Type 317, at left. The indoor air handling unit can be operated with or without a duct system.



The outdoor unit is fully weather-protected against the elements for installation in any climate. By placing the compressor assembly outside the home or business establishment, normal operating sounds are not noticeable inside, and easy access is provided for maintenance. The indoor unit can be suspended almost anywhere—in basements, attics and crawl spaces. No valuable floor space is wasted for the heating and cooling system.

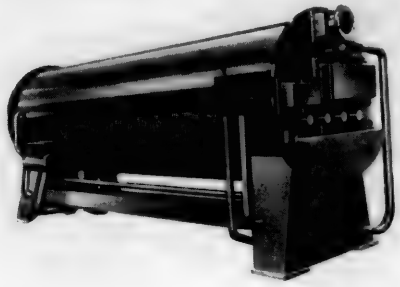
Supplementary electric resistance heating packages, Type 316, can be used with the heat pumps. These packages are available in 8 to 12 kw heating capacities which deliver 27,280 and 40,920 Btu per hr. The heating elements are sequenced through a control panel which energizes the elements in 4-kw increments.

More information? Circle Item 40, postcard, last page.

Hermetic Absorption Unit

A new, completely hermetic absorption unit, called the Cold Generator, which is powered by low-pressure steam and uses water as the refrigerant with lithium bromide as the absorbent, is introduced by The Trane Company, La Crosse, Wis. The unit is available in capacities from 100 to 350 tons, and is equally well suited for single or multiple unit installations.

Single-shell design and hermetic pumps prevent air leakage to maintain full-rated capacity and resist oxidation. The hermetic design and simplified purge system



make possible the purging of air from the machine only a few times a year which cuts maintenance to a minimum.

The unit uses a control system which operates the machine at conditions which avoid crystallization. Should crystallization occur, however, because of short periods of power failure, unit is designed to free itself once normal conditions are restored. Unit is lightweight, quiet and nearly vibration-free, permitting installation in almost any location where actual weight of the unit can be supported.

More information? Circle Item 41, postcard, last page.

Transmitter Transistorized

Model RO7903 electronic-pneumatic transmitter, available from Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., is said to combine the advantages of electronic sensing and pneumatic actuation in a transistorized controller. The result is greater stability, more accuracy and longer, trouble-free performance.

Transmitter is used to control temperature in central fan systems. A choice of sensing elements is offered to match the exact needs of each system. These elements include: Insertion elements, duct elements, outdoor elements, averaging duct elements, room thermostats, and dual-acting discharge elements. There is a free choice of sensor locations because these elements no longer need be accessible for periodic system adjustment.

More information? Circle Item 42, postcard, last page.

Versatile Fan-Coil Unit

A fan-coil unit introduced recently by Heating and Air Conditioning Div., National-U. S. Radiator Corp., Johnstown, Pa., is said by the maker to provide all-season air conditioning with hydronic systems for residential as well as commercial applications.

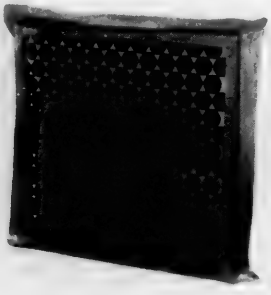
The Spotaire VRS fan-coil unit features a three-speed push-button individual room control and an optional 10 x 4-inch adjacent room supply. The adjacent room supply permits the conditioning of two small rooms with a single VRS fan-coil unit. Damper-controlled diverted air is directed through flush-mounted grille into a second room. Units can be recessed between standard 16-inch studs or installed free-standing in existing buildings.

Cabinet of the Spotaire unit is constructed of 20-gage steel with expanded metal supply and return grille, and is insulated with ½-inch vinyl-coated fiber glass. The filter is positioned behind the return grille. Units are furnished in two sizes: Model VRS-2-150 has a rated nominal capacity ranging from 2,500 to 5,500 Btu per hr with a 150 cfm air flow rate. Model VRS-2-300 is rated at double the capacity of the smaller unit.

More information? Circle Item 43, postcard, last page.

Disposable Odor Filter

American Air Filter Co., Inc., Louisville, Ky., has introduced a disposable activated carbon odor filter. Representing a new concept in odor filter design, the company states, the filter combines high-efficiency odor removal with a high degree of air cleaning in one low-cost, disposable-type unit. By combining both odor removal and air filtration, these units are said to result



in a considerable saving for the user when compared with most other activated carbon filters on the market today.

Activated carbon adsorption is a positive, practical method for the control of odors and other unwanted gases. It can be used in almost any situation where contaminants in vapor form should be removed from an enclosed space.

These odor filters eliminate the costly process of reactivation, and are offered in four standard sizes to fit conveniently in standard 2-inch frames.

More information? Circle Item 44, postcard, last page.

Self-Contained Chiller

Latest addition to its Chillpak line is Type SCC water chiller, announces Governair Corp., Oklahoma City, Okla.

Chiller is said by the manufacturer to offer the ultimate in the advantages of a package system. Available in

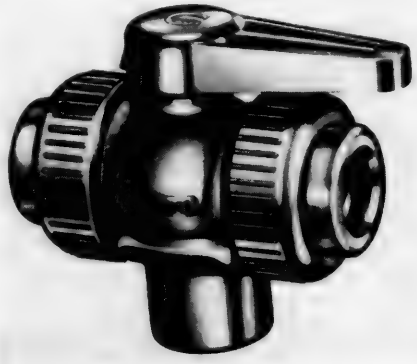
twelve models, from 15 to 120 tons, units are completely self-contained, with all components, including an evaporative condenser, in one compact, attractive cabinet.

Elimination of the need for a cooling tower, the company points out, greatly simplifies installation.

More information? Circle Item 45, postcard, last page.

Plastic Three-Way Valve

Designed especially for systems handling corrosive liquids, an all-plastic 3-way valve is offered by Chemtrol, Lynwood, Calif. It is available in ½-, ¾-, and 1-inch port sizes.

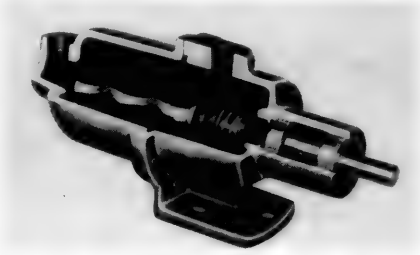


Valves are equipped with Teflon seats and quad type ring seals. All parts are replaceable for ease of maintenance and union type end connectors are employed, permitting rapid disassembly, even after installation. Choice of threaded IPS connectors or sockets for solvent welding is offered.

More information? Circle Item 46, postcard, last page.

Deep Well Submersible Pump

The company's newest development in water system submersible pumps is the Spirit, incorporating the helical screw principle, reports Continental Pump Co., St. Louis, Mo. With a single corrosion-resistant rotor turning within an abrasion-resistant stator, the Spirit is said to handle more water from greater depth with less horsepower and at lower cost.

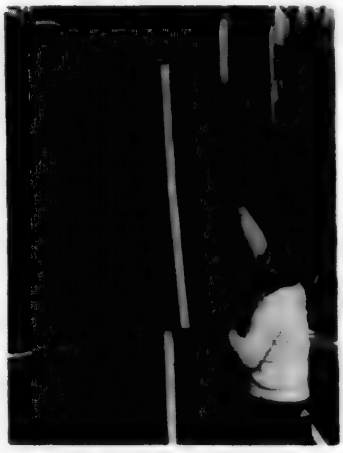


A ⅓-hp unit available with 115 or 230-volt, single phase, 60 cycle motor, it yields 4 gpm from 150 ft against 40-lb tank pressure. Simple in design, yet ruggedly built, it performs in varying water levels without adjustments, the company states.

More information? Circle Item 47, postcard, last page.

Versatile Felt Insulation Line

A line of spun mineral wool felt insulations designed for use in high temperature industrial equipment, heated appliances, and refrigeration systems is announced by Baldwin-Ehret-Hill, Inc., Trenton, N. J. B-E-H Spun Felts are available in densities ranging from 3 to 8 lb per cu ft and with a variety of surface facings. This versatility enables the engineer and designer to select the correct insulation to meet the thermal and other physical requirements of most applications.



Some suggested high temperature applications are ovens, dryers, stoves, and ducts. In addition, the material is designed for use on refrigerated surfaces of freezers, cold storage facilities, locker plants, and air conditioning systems. Made from spun mineral fibers with a phenolic resin binder, felts can be used to insulate surfaces having temperatures from below zero to 450 deg F. If mechanically supported and enclosed, they may be used satisfactorily up to 600 deg. Lightweight and resilient, the felt insulation is incombustible, non-corrosive, and moisture-resistant. It is easy to cut and fit with a knife or saw.

Thermal conductivity ranges upward from a minimum *k*-factor of 0.24 Btu per (sq ft) (hr) (deg F) depending upon the density of the material and the temperature of the insulated surface. The variety of facings and coatings provide an application flexibility which allows the material to be tailored to the job.

Standard felts are available in densities of 3, 3.5, 4, 6 and 8 lb per cu ft. The two lowest density materials are flexible. Four-pound and higher-density felts are semi-rigid.

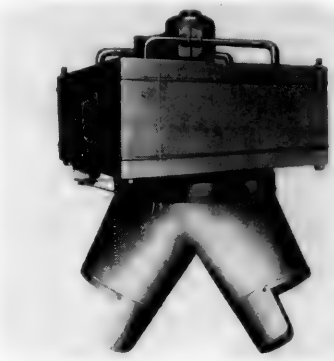
Coatings include black Kraft vapor barrier paper, Kraft paper and asphalt laminate, scrim reinforced aluminum foil laminated with flame-proofed Kraft paper applied with a flame-resistant adhesive, aluminum-pigmented vinyl film, and embossed aluminum foil. Six- and 8-lb density felts are also available with a black or clear Neoprene coating.

Felts are available in thicknesses of from 1 to 4 inches in ½-inch increments. Felt sizes are 24, 30, 36 or 48 inches long by 12 or 24 inches wide.

More information? Circle Item 48, postcard, last page.

High-Level Circulating Units

Units for recirculating ceiling-accumulated warm air, to put this otherwise waste heat back to work, are added to its line by L. J. Wing Mfg. Co., Linden, N. J. These high level circulating units consist of fan, plenum chamber with air guides, and revolving or fixed discharge. They draw in heated air which accumulates at the ceiling of industrial buildings and recirculate it downward to the floor, thus reducing the load on building heating systems. Revolving discharge type, illustrated, is used to constantly change the direction of downward flow, to prevent hot spots and the blocking of flow by machines, stacks of materials, and other obstacles. The units utilize the Wingfoil fan of compound curved airfoil design for moving air at high efficiency with minimum turbulence and noise.



High level circulating units may be used to circulate air in summer. With the addition of dust intakes from the roof, they may be used for summer fresh air supply. This type of installation aids exhaust systems in disposal of smoke, fumes, and odors. The circulators may be readily converted at any time to unit heaters by adding heating sections and steam or hot water lines.

More information? Circle Item 49, postcard, last page.

Valve for Hydronic Zoning

For hot water—chilled water heating and cooling systems, H. A. Thrush & Co., Peru, Ind., offers its zoning valve, which, the company states, makes zoned hot water heating easier to sell since it eliminates the need for extra circulators, flow control valves, and relay transformers. In addition, the Zone Valve requires low voltage wiring and is said to simplify piping.

Valve closes tightly, which tends to prevent costly overheating; it can be soldered into the line without taking the valve apart; and it has a visible wheel for manually opening and closing the valve, if desired.

Unit operates from standard thermostats and relays and can be installed in several different positions. It comes in ¾- and 1-inch sizes and all parts that are in contact with water are noncorrosive. Closed contact switches are said to help cut dirt and dust problems. Also, valve opens and closes gradually to eliminate the possibility of water hammer and noise.

More information? Circle Item 50, postcard, last page.

Mechanical Mat

The Miracle Mat, a modern mechanical mat manufactured by Progressive Engineering Co., Holland, Mich., automatically wipes shoes clean. Dirt, dust, mud and slush do not have a chance to get past the front door, and as a result, floor maintenance costs are cut 40% or more. Painting, decorating and cleaning costs are also

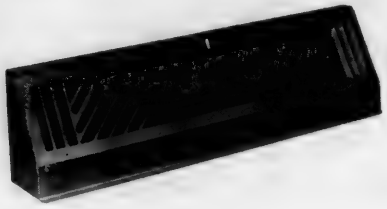
trimmed. And, in addition, the device is reported to trap the loads of dust that otherwise are pumped throughout the building by air conditioning and forced-air heating systems. Air conditioning filters stay cleaner longer.

The device is a heavy aluminum grille, rubber-mounted within a welded steel frame installed in the floor. Brushes run the width of the grille just below the slats. The pressure of a footstep depresses the grille, actuating limit switches and an electric motor which puts the brushes in motion at hundreds of strokes per minute. Three sizes are available for commercial, institutional and industrial use, two for residential installation.

More information? Circle Item 51, postcard, last page.

Low-Cost Perimeter Diffuser

The Valuaire, an economy-priced baseboard perimeter diffuser for heating or combination heating-cooling systems, has gone into production at The Auer Register Co., Cleveland, Ohio. The 18-inch-long unit is designed especially for housing project applications where low cost is necessary.



It features an advanced, flowing-line design which blends with any type construction and produces diffusion capacity equal to that of longer units, the company reports. A simple balancing adjustment allows accurate setting to desired cfm capacity. Standard finish is Buff-tone, which may be used as is or repainted to match the interior.

More information? Circle Item 52, postcard, last page.

Unit Heater Control System

Expansion of the company's Flexitemp control system to include its entire line of suspended unit heaters, in eleven capacities from 25,000 to 300,000 Btu, is announced by Reznor Manufacturing Co., Mercer, Pa.

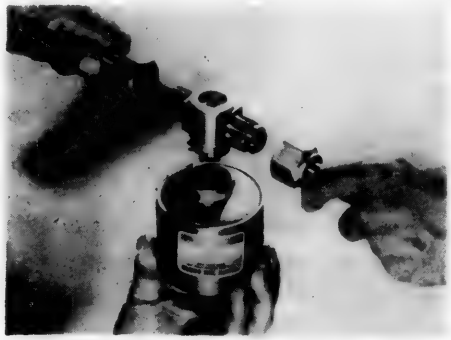
Because the sensitive control system virtually eliminates hot air blasts, it makes installation of higher capacity gas-fired unit heaters more suitable than ever before in offices, retail stores, restaurants, and other commercial establishments, as well as public buildings such as churces and auditoriums, according to the company.

Flexitemp controls combine a highly sensitive low voltage anticipating thermostat with a two-speed motor and an automatic fan speed selector which operate independently of the heater's burner controls. The controls pace the unit heater to existing weather conditions, matching heat production with heat distribution. The system provides low outlet temperature with gentle air circulation in mild weather, and more heat with vigorous air circulation when severe weather conditions prevail.

More information? Circle Item 53, postcard, last page.

Adapter-Type Filter-Driers

New adapter-type molecular sieve filter-driers and moisture-liquid indicator adapter fittings have been developed by Remco, Inc., Zelienople, Pa. When combined in use, the units answer the needs of air conditioning and refrigeration system installers who prefer filter-driers that can be replaced easily without disturbing line connections.

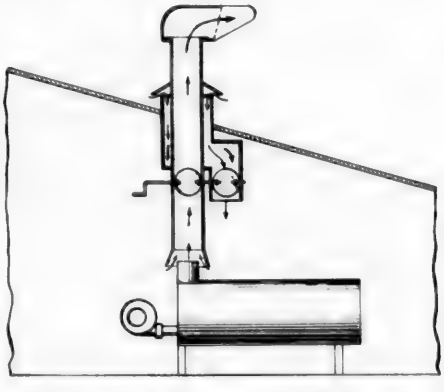


The moisture-liquid indicator adapter fitting (top center) is installed permanently in the refrigerant line, while the adapter-type filter-drier (bottom) can be quickly installed and replaced by screwing onto the bottom of the special adapter fittings. Both units are approved by Underwriters' Laboratories for 2500 psi minimum bursting pressure.

More information? Circle Item 54, postcard, last page.

Improved Compensating Flue System

An improved compensating flue system, insuring adequate air supply under all conditions of operation, has been developed by Eclipse Fuel Engineering Co., Rockford, Ill. Design of system features twin dampers controlling flue and air inlet openings at the same time and by the same operator. Dampers may be controlled by



limit switches for open position start, and closed position for shutdown of combustion equipment.

System was developed to meet the requirement of any blast-fired gas furnace, boiler, or other heating device for a minimum of 10 cu ft of air for each 1000 Btu of fuel burned. Since combustion equipment, often requiring thousands of cubic feet of air per hour, is frequently operated in closed rooms with insufficient air available, the burners may burn poorly and in extreme cases may even go out.

With the compensating flue system, all of the air required by the combustion system is replaced by new air entering the sleeve opening through the roof. Design of the fresh-air sleeve is such that it not only insulates the hot exhaust flue from contact with the roof, but provides partial preheat of fresh air coming into the boiler or furnace room. An optional, freely-rotating wind cap aids in moving products of combustion from the room.

More information? Circle Item 55, postcard, last page.

High-Speed Printmaking

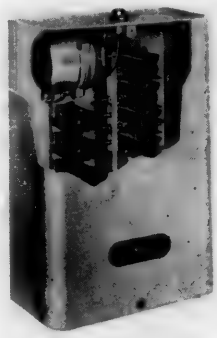
Eugene Dietzgen Co., Chicago, Ill., announces development of a high-speed Diazo blue. In a matter of seconds, the company says, directly from translucent originals, strong blue line reproductions can be printed. Developed dry with aqua-ammonia vapor, these easy to read prints are ready for use.

Driprint Blue is said to have amazing density and good contrast, giving excellent prints from pencil tracings and poor originals, and to be ideal on low powered light source machines for all types of reproductions and on high speed machines from poor or soiled originals.

More information? Circle Item 56, postcard, last page.

Switch for Step Control

A pressure-electric switch that provides step control of electric heat unit ventilators, fan systems, pumps, and refrigeration equipment is available from The Powers Regulator Co., Skokie, Ill. Called the MS (Multi-Step) switch, the device consists of a pneumatic motor which actuates a series of electric switches in response to a pneumatic signal.



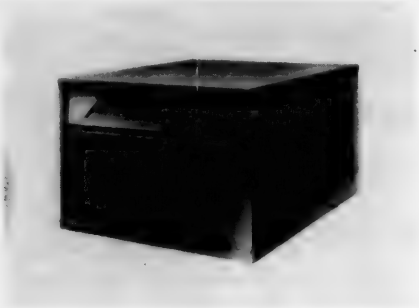
The company reports that the product is particularly adapted for use with unit ventilators having electric resistance heating elements. In this way, each element is energized in sequence in response to changing air signals passed by a pneumatic thermostat. The result is smooth, gradual control of heat output. Similarly, the MS switch can be used to provide sequence operation of other electrical equipment.

Normal supply pressure of the device is 15 psi; maximum supply pressure is 25 psi. Air connections are ⅛-inch NPT. Switches are rated at 20 amperes at 125, 250, and 460 v a-c; 1 hp at 115 v a-c; and 2 hp at 230 v a-c. Maximum ambient temperature is 160 deg F.

More information? Circle Item 57, postcard, last page.

Three-Ton Heat Pump

Carrier Corp., Syracuse, N. Y., has added to its line of heat pumps a three-ton model built in one weatherproof cabinet. It is suitable for commercial and residential application, and is similar to the two-ton model introduced a year ago. The one-piece unit has proved popular in residences, apartments and small office suites. Many of the two-ton units have been installed at a cost well under $1,000, including ductwork.



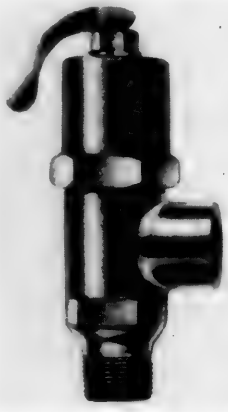
The three-ton heat pump extends the range of this type of equipment to larger residences and apartments. With a duct attached, it can be mounted on the roof of a commercial structure and heat and cool the interior either through a single large diffuser or through ductwork to handle several offices. The company also manufactures two-piece models in three, five and 7½-ton sizes.

Auxiliary resistance heaters are completely prefabricated and slip easily onto the discharge side of the unit when needed. Summer and winter operation of the heat pump is controlled by a single thermostat which switches the unit from heating to cooling and back again without attention. A separate outside thermostat is set at the temperature at which supplementary heating is required, switching on the resistance heaters when the temperature falls below that point.

More information? Circle Item 58, postcard, last page.

Pressure Relief Valve

Series 2000 is added to its line of ASME steam-rated pressure relief valves by The Patrol Valve Co., Cleveland, Ohio. For hot water tanks and heaters, valves have ¾-inch male or female inlet connections; ¾-inch outlet connections.



Construction, the manufacturer states, is of rugged bronze where in constant contact with water, assuring long life and corrosion-free service. Standard factory models have settings from 30 to 150 lb, but set pressures from 15 to 150 lb are available on request.

Also introduced are two new models in each of the company's Series 1000 (¾ inch) and 3000 (1 inch) of ASME valves, in pressure settings of 35 and 45 lb. Valves boast very high Btu capacities. All three series of valves can be manifolded into multiple units for even higher capacity ratings.

More information? Circle Item 59, postcard, last page.

Gage Mount Stops Jiggle

A gage mount that lengthens gage life by effectively damping out mechanical vibration and gage pointer jiggle is announced by Vilter Mfg. Co., Milwaukee, Wis. Named Stedy-Mount, the mount is designed for bottom-inlet gages weighing up to 2 lb.

The mount can be used for both ammonia and Freon or any other gas or fluid that does not attack carbon steel. It is especially applicable for use on reciprocating com-

pressors and piping systems in which the fluid or gas flow has pulsating characteristics.

A rubber damper isolates the pressure gage from the compressor or piping system, avoiding a rigid connection between the two and enabling the gage to stand motionless. Gas pressure is transmitted to the gage through a small-bore, stainless steel, spiral-wound tube so that only a smooth, even pressure reaches it and, as a result, its pointer does not jiggle.

More information? Circle Item 60, postcard, last page.

New Aluminum Alloy Sheet

A sheet alloy of aluminum, developed by Aluminum Company of America, Pittsburgh, Pa., is aimed at accelerating construction uses of aluminum by both industrial and residential building industries.

The new standard item is now being marketed in coils or flat sheet at prices said to be competitive with galvanized steel and kindred major building materials. According to the manufacturer, the building sheet possesses higher strength than most alloys currently employed for building products. Applications include residential siding, industrial building panels, heating and air conditioning ducts, and furnace fittings.

More information? Circle Item 61, postcard, last page.

Duct Connector Material

Asbestoseal, a fabric combining heat resistance, low air leakage, and economy for flexible duct connectors, is available from Duro-Dyne Corp., Farmingdale, N.Y.

Fabric is made of UL grade asbestos, coated with aluminum colored Neoprene to add strength and prevent the excessive air leakage of plain asbestos.

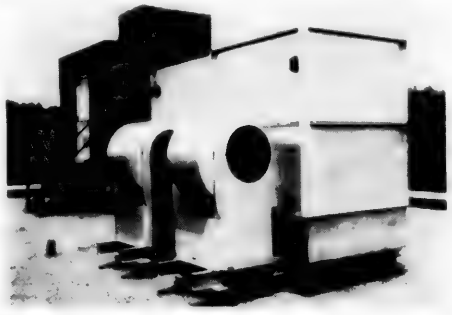
Recommended for use in heating as well as air conditioning installations, and manufactured in all three styles of flexible connector, fabric is fastened to metal by means of the company's Griploc method.

Samples and information are available, the manufacturer announces.

More information? Circle Item 62, postcard, last page.

New Line of Cooling Towers

A new line of water cooling towers, Series 4B, is introduced by Binks Manufacturing Co., Chicago, Ill. Chief features of the towers include quiet operation and low silhouette. Quiet operation is assured, the company reports, through the use of squirrel cage blowers rather than propeller fans. Sixteen sizes are available in the new line, with capacities ranging from 5 to 360 tons. Maximum heights range from 5′-5″ to 7′-8″, exclusive of foundation beams. Towers installed on roofs are seldom visible from street level even on comparatively low buildings.



Flexibility is increased, as shown in photo, by the use of multiple blowers on larger towers. These towers are made up of separate cells, used as a unit, but each cell is equipped with its own blower and drive. Individual cells can be operated independently if desired, making the towers adaptable to any weather condition.

Operation is simple, and moving parts are kept to a minimum. Air enters the blower, which is located at the external base of the tower, and is forced upward through the tower housing. Water to be cooled is sprayed downward into the tower from a nozzle array positioned at the top of the tower. The water passes over the redwood decking, effecting maximum exposure of water to air, then collects in a basin to re-enter the plant system. Drift eliminators positioned above the nozzle array hold escaping water to a minimum and reduce evaporation.

More information? Circle Item 63, postcard, last page.

All-Plastic Nozzles

Series PV, a line of nozzles made entirely of PVC (polyvinyl chloride) has been announced by the manufacturer, Bete Fog Nozzle, Inc., Greenfield, Mass.

For use wherever a non-metallic, corrosion proof nozzle is required, the new nozzles are claimed to be non-clogging and long wearing.

Made from one piece of PVC plastic, using the manufacturers patented spiral design, these nozzles are inexpensive, according to the manufacturer.

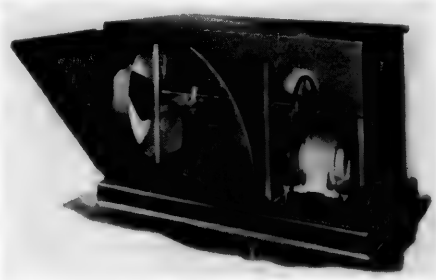
Nozzles are available in twenty-eight models with wide or narrow angle, full or hollow cone and seven different flow rates from 2 to 70 gpm.

More information? Circle Item 64, postcard, last page.

Packaged Roof Ventilators

L-Blow roof exhausters are announced by Romla Co., Los Angeles, Calif. They are completely packaged roof ventilators for commercial and industrial use.

According to the company, units will exhaust against medium static resistance efficiently and economically. LBA models are equipped with spark-proof aluminum alloy high-speed propeller. LBS models, utilizing wide



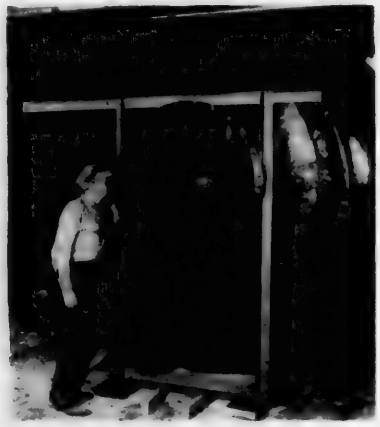
plate, slow-speed propellers, are used primarily where air must be exhausted quietly, against lower resistance and at the lowest possible operating cost. In each case, electric motor is entirely isolated from the air stream.

Automatic shutters may be supplied in place of cowl to provide complete closure when fan is not in operation. Acid-resistant coatings are available for chemical fume applications.

More information? Circle Item 65, postcard, last page.

Fiberglass Centrifugal Fans

Large size, all-resin-reinforced fiberglass centrifugal fans are available from du Verre, Inc., Arcade, N. Y. (Fan illustrated delivers 32,000 cfm at 2 inches of water static pressure driven by 25-hp motor at 786 rpm.) Both fan wheels and housing are of fiberglass to protect fan from corrosion inside and out.



Wheels are dynamically balanced to insure completely vibrationless operation. Construction is not only lightweight and strong but smooth also, so material does not tend to collect on internal surfaces to cause unbalance and vibration problems. No external painting is required.

The company offers a complete line of resin formulations to suit most corrosive conditions in fabricating in the present line of centrifugal blowers. In addition, it offers complete facilities for the fabrication of duct work, hoods and other process vessels in accordance with specifications.

More information? Circle Item 66, postcard, last page.

Protective Paint

A general-purpose, one-part Neoprene rubber based coating that is said to provide excellent chemical, abrasion and weathering resistance for the protection of metal, wood, concrete, cloth and some plastics, with the added advantage of reducing application costs, is available from Adhesives, Coatings and Sealers Div., Minnesota Mining and Mfg. Co., St. Paul, Minn.

Designated as Coro-Gard 1706 protective coating, it has high adhesion to unprimed steel, aluminum, copper, galvanized steel, concrete, wood and glass fiber reinforced polyester plastics, the company states. When applied to these surfaces, the coating will air-cure to a tough rubbery protective film that has good resistance to the corrosive action of chemicals and fluids. Particularly outstanding is its resistance to a 20% concentration of hydrochloric and sulfuric acids, distilled and salt water, and alkalies, at continuous service temperatures up to 120 deg F.

According to the manufacturer, excellent abrasion resistance of the coating has been demonstrated in dust collectors of asphalt plants. It also protects against abrasion and erosion caused by the flow of liquids containing silt and sand.

The coating remains flexible and strong under varying weather conditions of sunlight, rain, snow and wind. Outstanding resistance to deteriorating effects of ozone, oxygen and industrial atmospheres is another important property.

Coating features that reduce total application costs are its applicability to surfaces without a special primer, thus eliminating the extra expense for a primer and cutting application time, and elimination of the requirement for addition of an accelerator or catalyst for curing.

Because it is of a gel-type consistency, the coating can be applied by brush without the need of diluting or stirring. Even when applied to vertical surfaces, the new coating will not sag or flow, but will remain in position until it dries to a solid rubbery film. Only one or two coats are required on most applications to achieve the proper thickness and provide the necessary protection against corrosion, abrasion or weather conditions.

Typical uses in air conditioning: For protecting drip pans, fan blades, cooling towers, tanks and ducts against condensed moisture, mold, erosion, and weathering.

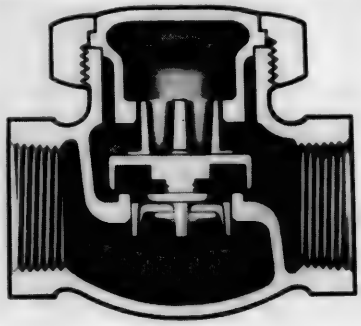
More information? Circle Item 67, postcard, last page.

Two Bronze Valve Lines

The No. 229C 200-lb bronze globe and No. 239C lift check valves are announced by Crane Co., Chicago, Ill. The lift check valve is illustrated.

Both valves have integral body seats with a semi-crown face instead of screwed-in seats as was the case in the valves they replace, the 212C and the 218C.

The disc holder on the new globe valve is of the slip-on type. No threaded disc stem ring is employed.



The slip-on disc holder makes for fast and easy repair by either the insertion of a new composition disc or the replacing of the disc holder and disc as a complete unit, the company explains.

The new valves are regularly furnished with No. 4 Cranite discs. This disc is suitable for high pressure steam up to 450 deg F. When ordered for cold water, air, gas, oil, or gasoline, the valves are furnished with a No. 6 disc.

No. 4 disc is laminated and consists of a synthetic base with spirally wound long fiber asbestos and other ingredients. No. 6 disc is made of a composition with a synthetic base. It is soft enough to make a tight seat on air or gas, yet resistant enough to withstand hot water and the wear and tear of repeated operation.

More information? Circle Item 68, postcard, last page.

Non-Chattering Relief Valve

A non-chattering relief valve for liquid service is announced by J. E. Lonergan Co., Philadelphia, Pa. The new Hydro-Valve is designed specifically to be stable and non-chattering, and to provide full-rated capacity in liquid service. It will not drum, chatter, or hammer on any application, either by-pass or emergency relief. Materials handled in dozens of test installations over the past three years have included water, fuel and lube oils, and hazardous, flammable liquids.

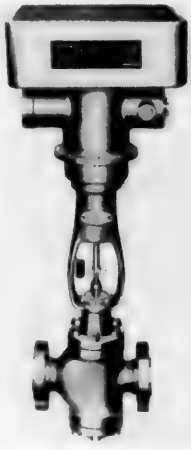
There are no extra springs or other mechanisms in the valve to eliminate chattering by dampening its movement as it is displaced from its seat. Instead, the hammering is eliminated by a special design of the throat, seat, and baffle construction. Unit is available with a bellows, if necessary, to keep working parts away from contaminants, and corrosive or viscous fluids.

Valves are available with all body and trim materials used by the industry. The plain valve comes in regular sizes from 1 to 8 inches; the bellows version is available from 1½ to 8 inches in size.

More information? Circle Item 69, postcard, last page.

Actuator Mechanism Refined

An improved model of the vapor-powered Thermo-Drive actuator for electronic control systems has been introduced by The Swartwout Co., Inc., Cleveland, Ohio. While retaining the original thermal-release principle that positions final control elements without compressed air, motors, gear trains, pumps, oil, amplifiers, or relays of any kind, the new device is characterized by several design refinements which permit stroke and zero adjustments, and provide full operating thrust with lower internal pressures.



This latest model remains a simple device, with only two moving parts. An electrical resistance strip heater vaporizes a liquid at a continuous rate. The pressure of the vapor drives a diaphragm against the valve actuating stem. The primary difference between this and the earlier model is a more efficient vapor-producing liquid which has a high boiling temperature at a pressure less than 40 psi. Originally Freon was used, and pressures of 200 to 400 psi were needed to achieve the high boiling temperature necessary for efficient removal of heat from the system. The high pressures made it necessary to employ an expensive bellows to drive the actuating stem. By reducing the operating pressure of the device, the company has been able to replace the bellows with a conventional diaphragm topworks that retains the essential simplicity and dependability of the unique actuator.

Positioning control is accomplished by varying the heat-release from the system. A valve regulates the flow of vapor to a heat-exchange surface where a second liquid, Freon, transfers the heat to an ambient-exposed condenser. A moving force coil, energized by the controller signal, and coupled to a mechanical feedback arrangement, controls the heat-release valve.

When the heat-release rate is decreased, vapor pressure against the diaphragm increases, driving the actuating stem downward. When the heat-release rate is increased, the reduced vapor pressure allows the diaphragm to contract, causing an up-stroke of the actuating stem.

Actuator develops 300 lb of thrust and has an adjustable stroke span of 0.5 to 1.5 inches. Response speed is 0.1 inch per sec. An explosion-proof housing makes it suitable for Division I locations.

More information? Circle Item 70, postcard, last page.

Stronger Insulating Firebrick

A stronger and improved insulating firebrick—said to be the lightest in weight and the lowest in thermal conductivity of any firebrick available today—is placed on the market by The Babcock & Wilcox Co., New York, N. Y.

Known as B&W K-20 and K-23, the insulating firebrick was engineered to meet the requirements of the metals, structural clay, petroleum, chemical and glass industries.

Mechanical strength of the refractory has been increased by more than 65% for the K-20 and by more than 50% for the K-23. This increase, officials claim, will enable the insulating firebrick to be used in a wider range of applications. It can be fitted with hangers or pins without danger of breakage.

The K-20 has an average weight of 1.70 lb per 9-inch straight, while the K-23 9-inch straight averages 1.85 lb.

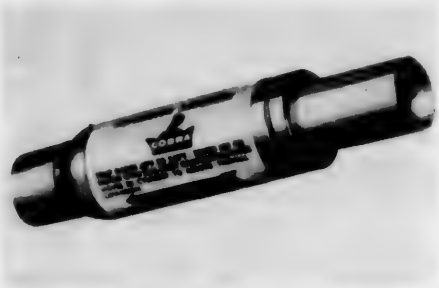
The brick also offers a lower thermal conductivity and stores less heat, the company states. Superior resistance to direct flame exposure enables the insulating firebrick to withstand the erosive effects of circulating gases and flame impingement.

Firebrick can be tailor-cut, drilled or shaped as necessary. By using ordinary wood-working tools, the brick can be cut and shaped on the job in minutes.

More information? Circle Item 71, postcard, last page.

Expansion Absorber

A sliding piston type expansion absorber is announced by Cobra Metal Hose, Chicago, Ill. Featuring a piston-within-a-cylinder design, the expansion absorber utilizes a proven mechanical principle combined with sure-sealing rings. Foreign matter is kept from entering the mechanism at the end of the cylinder by a hygroscopic seal.



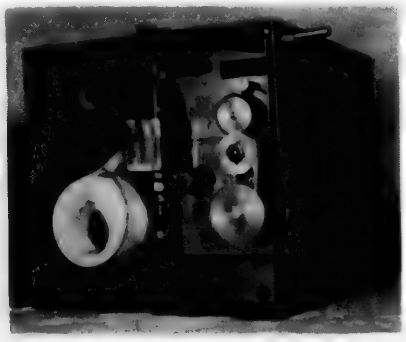
Expansion and contraction of pipe in all hydronic heating systems is compensated for by the piston action. Constructed of heavy-duty copper, the expansion absorber is available from ½ through 2-inch ID, with a female and a male tube end. The smallest size will absorb expansion of 2 inches; larger sizes have even greater capacity.

More information? Circle Item 72, postcard, last page.

Tape Air Sampler

A portable paper tape air sampler for recording dust or gas concentrations is available from Gelman Instrument Co., Chelsea, Mich. Said to be inexpensive, it will automatically collect up to 900 dust or gas samples by sucking air through a paper tape.

Volume of air per sample is adjustable from 1.5 to 36 cu ft. For dust measurements, the darkening of the ½-inch diameter sampling spot is measured with a densitometer. If radioactive dusts are involved, the tape can



be passed under a Geiger counter. For gas measurements, there are available specially treated papers that change color in the presence of many gases, such as hydrogen sulfide, carbon monoxide, hydrogen cyanide, and phosgene, it is announced.

Designed for use in the field, compact, and portable, the sampler's steel case weighs 21 lb. It has a volumetric piston vacuum pump with graphite rings that require no lubrication. The linear air flow rate through the filter is sufficiently high to assure good sensitivity and the special gas detection paper is readily capable of detecting and measuring low concentrations of harmful gases, the company states.

It is expected that this sampler will have many applications in several different fields. In industrial hygiene, the sampler can automatically and continously sample the air in potentially hazardous locations. By using a tape impregnated with lead acetate, for example, less than 1 part per billion of hydrogen sulfide can be detected. (The maximum allowable concentration for industrial workers is about 20 parts per million.) Although hydrogen sulfide has a distinctive odor, exposure to the gas deadens the sense of smell so that one can not rely on its detection by smell. For gas detection a pre-filter would be used to remove the dust from the air, so that the darkening or color change of the paper can be correlated with the concentration of gas in the air.

In air pollution studies, an array of these portable samplers can be used to obtain maps showing the distribution of a pollutant in an area and its variation with time. This information is useful in correlating the dispersal of pollutants with meterological conditions.

More information? Circle Item 73, postcard, last page.

Relief Valve Line Expanded

Expansion of its relief valve line to include 10 models with either ½- or ¾-inch male inlets is announced by Mansfield Sanitary, Inc., Perrysville, Ohio.

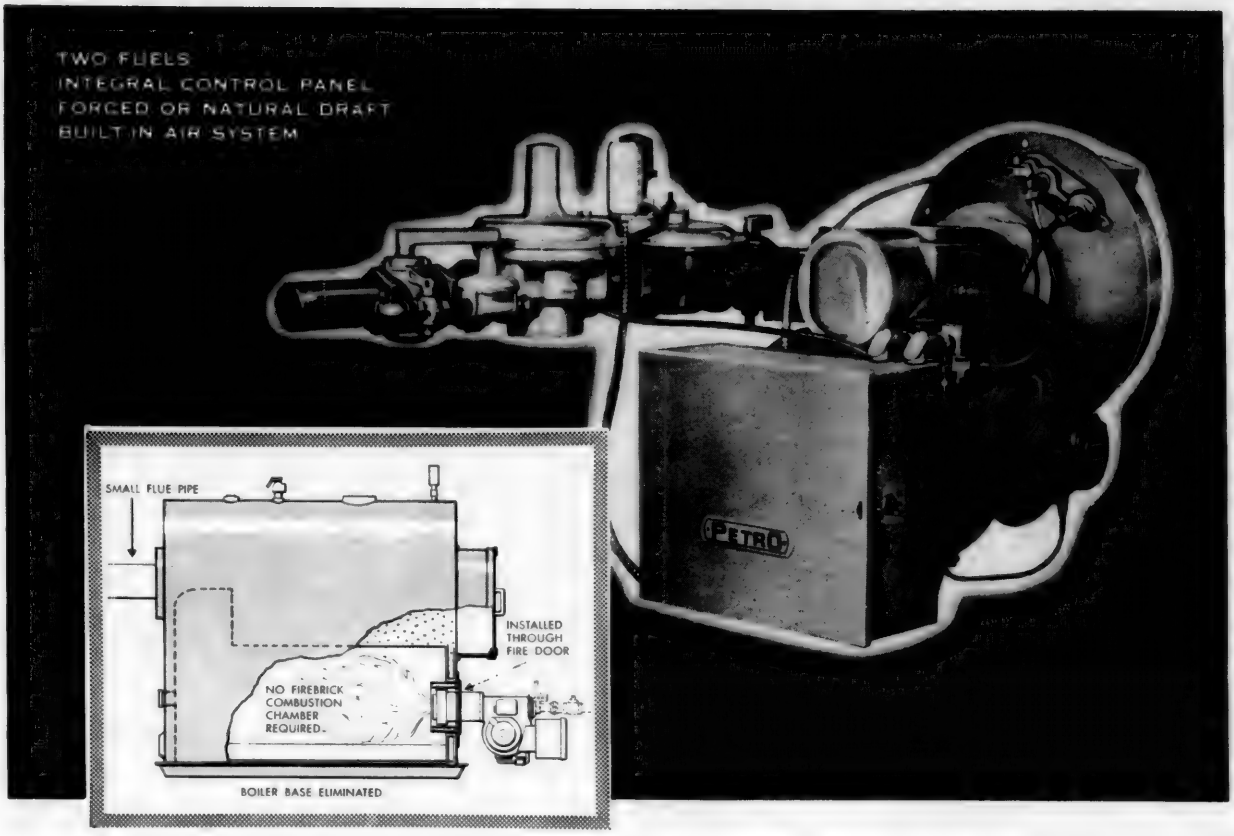
The units, automatic reset models designated Nos. 498 and 499, protect against both excessive pressures and temperatures when inserted in hot water lines or tanks. Both are furnished with 6-inch extension tubes which provide contact with the hottest water in tanks and assure instant relief when temperatures exceed settings. Valves close automatically after a 10-deg F temperature drop.

Both models are exactly alike except that No. 499 is equipped with a combination test lever and adjusting key that fits exactly into the slot on the top of the pressure cap. By looking across the valve top and following figures marked on the lever, pressures can be quickly and accurately set, the company states.

More information? Circle Item 74, postcard, last page.

(Continued on page 108)

New all-in-one burner *bolts to boiler front*



Average installation saving in firebox boilers: $250

Substantial savings in installation costs are made possible in a firebox boiler by the elimination of the boiler base and fire brick combustion chamber. Fits any boiler; bolts to the boiler front. Complete forced draft, fuel and control systems are built into the burner. No secondary air construction needed.

Also available as boiler-burner unit

Packaged boiler with integral burner can be delivered at site, ready for service connections. No brickwork, pit, or special setting required.

No high stack needed

In a sealed fire box no stack is required; merely a vent. Air is supplied under forced draft. In conventional boilers the stack can be shorter and smaller than required by the usual gas or oil burner.

Switches fuels instantly

Burns either fuel with high efficiency. Saves purchase of extra burner in areas where gas users must provide standby oil equipment. One-fuel models are also available for either gas or oil.

Cuts fuel costs

New type of burner head and improved fuel-air control develops exceptional combustion efficiency. Instant heat absorption. No wasteful refractories to heat up.

Costs less to operate

Requires no more supervision than a domestic burner. Maintenance problems are negligible, and can usually be handled by the janitor.

Capacities: oil, 4 to 30 gph; gas, 500,000 to 4,000,000 btu/h.

Send coupon for full description and specifications

Makers of Quality Heating and Power Equipment since 1903

PETRO

T. M. REG. U. S. PAT. OFF

PETRO, 3329 W. 106th Street, Cleveland 11, Ohio
(In Canada: 80 Ward Street, Toronto, Ontario)

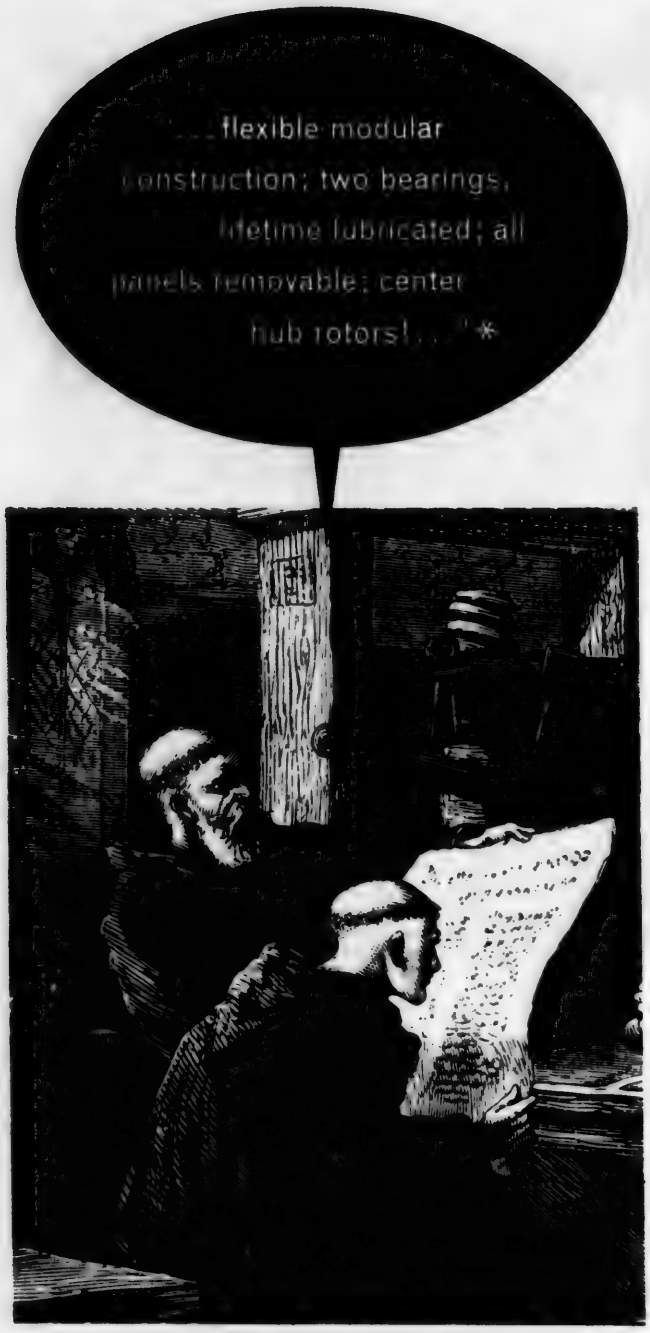
Please send complete information on Petro P-240 dual-fuel burner and boiler-burner units.

Name_____

Company _____

Address _____

City _____ State _____



"...and packed with many more facts in a just-printed, 48-page catalogue about what D-H *now* offers you in its popular 30-model central station air conditioning units (horizontal and vertical). Handy time-saver fan performance curves included, too!" Contact direct for Engineering Manual No. CSHV 312, and name of Manufacturer's Agent nearest you. *Send for yours.*

MEMBER OF AMCA

drayer-hanson

DIVISION NATIONAL U.S. RADIATOR CORP

3301 MEDFORD ST., LOS ANGELES 63, CALIF.
CABLE: CLICONI, LOS ANGELES

(Continued from page 106)

Coolers Have Refrigeration Package

Sunroc Corp., Glen Riddle, Pa., announces a variety of water coolers which can be guaranteed twice as long as any other coolers because of their unique features. These are the various new Sunroc coolers with packaged cooling — a new refrigeration concept that eliminates major field service.

Packaged cooling refers to the separate inside cabinet that houses the entire refrigeration system in the company's coolers, whether of the remote type, off-floor type designed for wall mounting, or coolers with inside plumbing to allow flush-to-wall installation. Only 12½ x 20 inches, this compact inner cabinet is a self-contained unit that permits more convenient installation, and is easily removed for prompt factory service or replacement as guaranteed. Major service is thus accomplished without removing the entire cooler—or without dismantling the cooler cabinet.

Packaged cooling provides instantaneous cooling of fresh water drawn through seamless copper coils with reserve capacity for peak requirements.

More information? Circle Item 75, postcard, last page.

Polystyrene Pipe Covering

Availability of pipe covering made of Uni-Crest expanded polystyrene for a wide range of design conditions is announced by United Cork Companies, Kearny, N. J.

Already widely used in slab and block form for a variety of low temperature insulating requirements in the residential and commercial building fields, this product will effectively stop costly heat gain and prevent condensation and dripping, it is stated. It has a low k factor, is odorless and nontoxic, will resist moisture, and has a compression strength of 16-20 psi, thereby permitting the use of outside hangers without preparation.

Covering is available in three standard sizes in both regular or self-extinguishing types. Light duty—nominal 1 inch for temperatures above freezing; medium duty—nominal 1½ inches for temperatures of 32 deg F and heavy duty—nominal 2 inches for temperatures of 0 deg to −30 deg. Extra thicknesses are available for more severe conditions.

When required, paper and foil laminate jackets are applied at the factory for additional protection. The jacket also permits a choice of colors for this otherwise white material.

More information? Circle Item 76, postcard, last page.

Pocket Slide Rule Has 15 Scales

Eugene Dietzgen Co., Chicago, Ill., announces the 1776 Redirule slide rule which is said to provide big rule design with pocket-size convenience. Made of non-warping, acrylic plastic with 15 deep-etched scales (K,A, B,T,ST,S,D,DI and DF,CF,CIF,CI,C,D and L), it solves almost any conceivable problem.

A handsome all-leather case with stainless steel pocket clip protects rule from damage and insures against loss. A complete instruction manual is provided.

More information? Circle Item 77, postcard, last page.

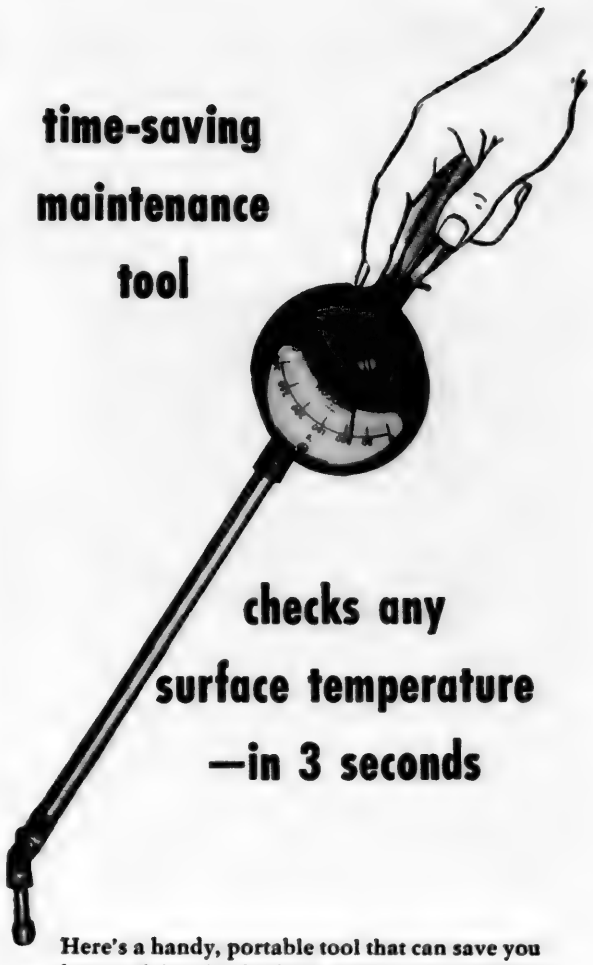
Basin Type Lather Dispenser

Model B-899 basin type lather dispenser is a top-filling unit that is said by its manufacturer, Bobrick Dispensers, Inc., Brooklyn, N. Y., to measurably reduce labor costs of filling and servicing.

The dispenser's 16-oz rigid, high-density polyethylene globe is translucent and unbreakable, impervious to discoloration and distortion. Dispenser is tamper-proof push-button spout machined of stainless steel.

Model B-899 dispenser is available to fit porcelain enameled steel or cast iron lavatories; it can be furnished (as Model B-899-Long) for mounting in vitreous china lavatories and through counter tops. Both of these models are available with a plated metal globe as Model B-899 MG and B-899 MG-Long.

More information? Circle Item 78, postcard, last page.



Here's a handy, portable tool that can save you hours of time in checking surface temperatures of steam traps, water lines, electric motors, bearings, etc.

The Alnor Pyrocon gives instant, accurate temperature readings of any surface: metallic or non-metallic, flat, curved—even revolving surfaces. It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use...performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 2000° F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Room 514, 420 N. LaSalle St., Chicago 10, Ill.

PRECISION INSTRUMENTS
FOR EVERY INDUSTRY

Alnor®

PVC Blowers for Laboratories

Direct-drive, corrosion-resistant utility blowers, designed for use in laboratories where corrosive fumes or moisture are a problem, are introduced by Industrial Plastic Fabricators, Inc., Norwood, Mass.

Designated PVC utility blowers, the line is constructed of unplasticized rigid polyvinyl chloride. This material

resists corrosion from almost all types and combinations of fumes, it is stated, whereas conventional coatings normally only resist a single type of chemical fume.

Units are available in three models with ⅓, ¾, or 1-hp motor and in capacities from 399 to 2000 cfm. Because of compact construction, they are particularly adaptable to laboratory hood and similar exhaust systems.

More information? Circle Item 79, postcard, last page.

Floatless Pump Controller

Availability of a new Sealtrode sealed electrode floatless pump controller is announced by Chicago Pump Co., a division of Food Machinery and Chemical Corp., Chicago, Ill.

According to the manufacturer the controller is a valuable accessory for sewage and drainage sump pumps available only with the Chicago pump line. With this pump controller the sump pump owner has every advantage of other floatless controllers, it is said, plus the following advantages of being sealed:

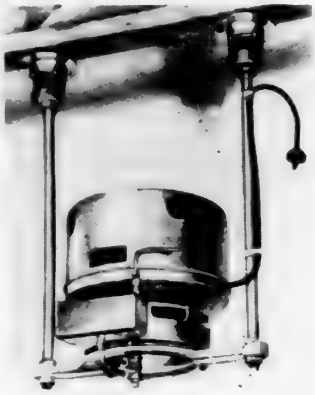
Electrodes never become insulated and coated with grease, oil, or soap. Electrodes are never affected by corrosive elements in sewage and drainage water. There are no moving parts parts in the liquid. By eliminating the need for duplex float switches and float guide pipes, original cost is lowered. Maintenance cost is lower.

Controller is a device for controlling the operation of one or more pumps. As liquid level rises in the wet well, a hydrostatic pressure is exerted on the flexible bulb, which tends to squeeze the bulb, causing the displaced liquid to rise in the 2-inch support pipe towards the electrodes. Liquid level in the pipe will always equal the level of the liquid in which the controller is submerged, since density of both liquids are equal. As liquid within the pipe rises and falls, it makes and breaks electrical circuits with the electrodes, activating the pump starters through the controller relays.

More information? Circle Item 80, postcard, last page.

Industrial Humidifier

A self-contained humidifier for industrial use, Model 42-A, complete with Model 32-W dial-type Humidostat, is announced by The Standard Engineering Works, Pawtucket, R. I.



Unit is sold with all the equipment needed for an installation. Motor driven, the humidifier has four-way horizontal distribution of the water vapor. It can be used in low-ceilinged rooms and may be used in multiples for large areas.

This is how the unit operates: Water is fed to the basin of the humidifier through a float tank, which maintains a constant water level. Attached to the motor shaft is a cone and disc. The cone sets in the water, and upon starting of the motor, water travels up the cone outwardly under the disc, striking grid vanes with great force, breaking up the water so that it emerges in a fog-like mist.

More information? Circle Item 81, postcard, last page.

Coal-Fired Packaged Generators

Users of packaged steam generators have always been restricted to gas and oil firing in all capacity ranges but the lowest. Now, for the first time, an economic choice of packaged steam and power supply is offered in coal-fired units of substantial capacity. The fully tested units are available from Foster Wheeler Corp., New York, N. Y., in standard sizes of 43,000, 50,000 and 63,000 lb steam per hr with pressures up to 250 psi.

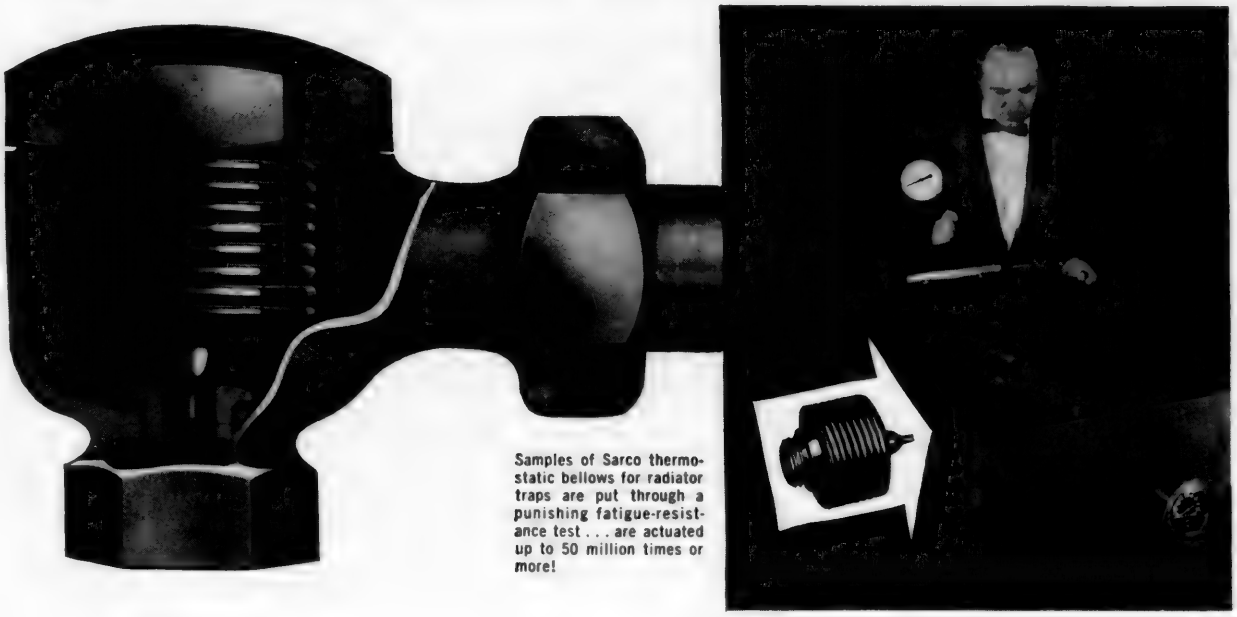
Designed and developed for the Bureau of Yards and Docks of the U. S. Navy, the water-tubed unit, under test at U. S. Naval Hospital, Great Lakes, Ill., has been operating continuously at 54,000 lb per hr with efficiencies of more than 80%. Flexibility, smokeless operation, variety of fuels, and semi-automatic operation are among advantages.

More information? Circle Item 82, postcard, last page.

(Concluded on page 112)

50,000,000 cycles can't be wrong!

How Sarco guarantees "on-the-job" performance of Thermostatic Radiator Traps



Samples of Sarco thermostatic bellows for radiator traps are put through a punishing fatigue-resistance test . . . are actuated up to 50 million times or more!

This is the most gruelling test a thermostatic radiator trap could possibly get. It's a thermostatic bellows test that goes on endlessly . . . day after day, year after year . . . in the Sarco Research Lab.

In this Sarco research and product development work, thermostatic bellows for Sarco radiator traps are expanded and contracted 50,000,000 times or more to test and study their fatigue-resistance!

Further to assure you the utmost on-the-job dependability, production samples of Sarco thermostatic bellows are tested to *10 million cycles* and more!

OTHER IMPORTANT ADVANTAGES

Extra-strong union nut and nipple — made of bar stock, not just brass castings.

Extra-rugged body — insured by *pressure* casting. Eliminates porosity. Maximum insurance against hidden defects.

Every body pressure-tested at maximum rated steam pressure.

Removable seat — for easy replacement. Seat and self-aligning valve head made of hard bronze.

ASK FOR BULLETIN 150

FOR UNDIVIDED RESPONSIBILITY on your installations, it pays to specify and order from one "Complete Line" source . . . SARCO-SARCOTHERM. Write for catalogs — to Sarco Company, Inc., 635 Madison Ave., N.Y. 22, N.Y

2213-B

SARCO

AN AFFILIATE OF SARCOTHERM CONTROLS, INC.

Products you can rest your reputation on

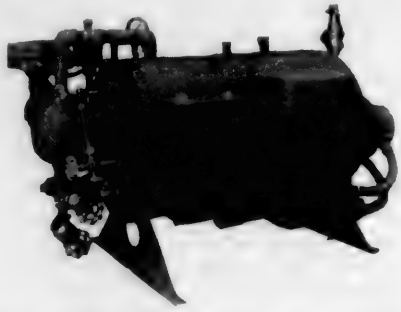
STEAM TRAPS • TEMPERATURE CONTROLS • HEATING SPECIALTIES

Radiator Valves • Traps | Strainers | Float-Thermostatic Traps | Camlift Bucket Steam Traps | Thermostatic Traps | Water Blenders | Air Eliminators | Dial Thermometers | Self-Operated Temp. Reg.

Small Electric Steam Boiler

A small electric steam boiler, introduced by P. M. Lattner Mfg. Co., Cedar Rapids, Iowa, is designed for 100 lb steam working pressure and is available in ten sizes, from 6 kw to 60 kw, or 0.6 hp to 6 hp.

According to the manufacturer, units have an over-all thermal efficiency exceeding 97%. Heavy-duty Chromalox heating elements, with larger than normal heating area, use only 40 watts per square inch of heating surface, a factor that lessens the chance of overheating if elements become corroded and which prolongs element life. Elements are flange mounted for easy removal for cleaning purposes.



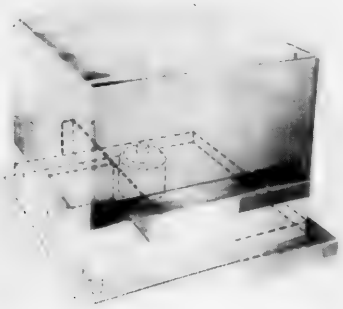
Boilers' large steam releasing areas permit fast withdrawal of steam without surging or priming. A thick mineral wool insulating blanket over the entire boiler shell is covered by a metal jacket.

Boilers are ASME Code and National Board inspected, stamped for 100 lb SWP, approved by Underwriters Laboratories, and listed under re-examination service.

More information? Circle Item 83, postcard, last page.

High-Volume Roof Ventilator

An industrial power roof ventilator said to exhaust 50 to 100% more air per horsepower than conventional units was introduced by Structa-Lung Co., Willoughby, Ohio. Units are available from stock in capacities from 8,000 to 80,000 cfm.



The ventilator's suction produces a jet that shoots upward 20 to 30 ft above the roof, and can be used any place where there is smoke, excess heat, or high humidity, the company states. Ventilator can be installed on any type of roof. The only maintenance work normally required is the annual removal of accumulated dirt with a long handled wire brush.

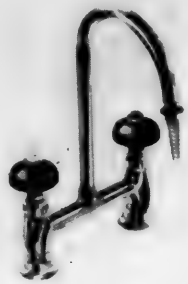
Rugged fan support assembly in the larger sizes consists of a framework 3 x 3 x ⅜-inch structural angles and ⅜-inch plate. Unit is of all welded construction and standard equipment furnished includes a fresh air breather duct to protect and ventilate the fan motor.

When the propeller fan is turned on, a pair of automatic dampers in the top of the ventilator opens to provide an unobstructed exit for the air. When the fan is off, the dampers close and form a leakproof seal. Optional features include a safety screen or work platform; special coatings for corrosive gases; and special high temperature construction.

More information? Circle Item 84, postcard, last page.

Laboratory Mixing Faucet

An easy way to furnish warm to hot water rapidly in the laboratory is achieved with the Lab-Flo Model BL-6100-1 steam and water mixing faucet, manufactured by T & S Brass and Bronze Works, Inc., Westbury, Long Island, N. Y.



The versatile gooseneck unit regulates flow and temperature by means of easy-grip, heat resistant, wheel-type handles, fitted with plastic color-coded indexes. It has floating stainless steel cones and stainless steel seats in both valves, with ½-inch IPS female inlets on 6½-inch centers.

Removable, ten-serration tapered hose tip provides secure hose connections. Heavy duty construction and extra heavy chrome plating will withstand long hard usage.

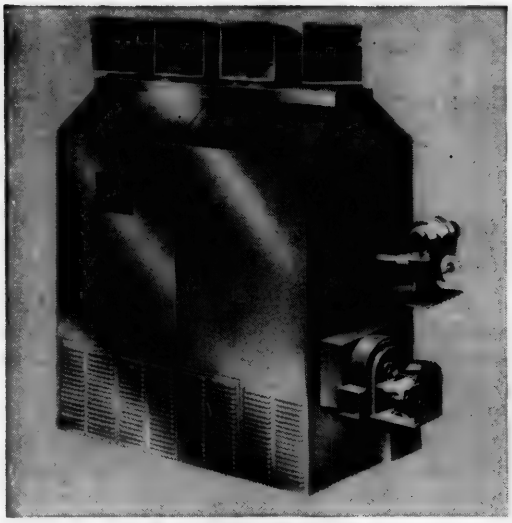
More information? Circle Item 85, postcard, last page.

Commercial Capacity Softeners

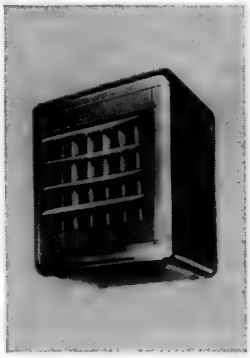
A new line of commercial capacity water softeners is announced by General Ionics Corp., Pittsburgh, Pa., a subsidiary of Salem-Brosius, Inc. Designed for use in commercial and light industrial applications, the line covers a range of flow rate capacities from 25 to 80 gpm, with ion exchange capacities from 175,000 to 600,000 grains.

This line of softeners is available in manual, push-button automatic, clock-actuated automatic, and meter-initiated automatic designs. Brine tanks supplied with the softeners are butyl-rubber-lined with stainless steel distributors, extra heavy heads and side sheets, and primed exterior surfaces. The system is shipped completely assembled on wooden skids, ready for installation.

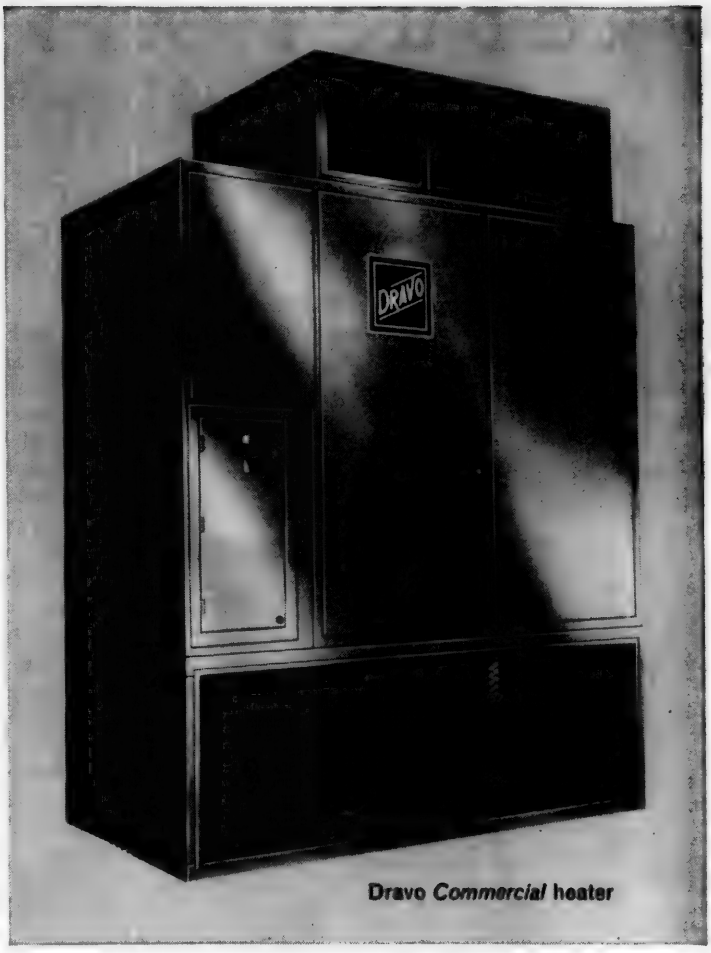
More information? Circle Item 86, postcard, last page.



Dravo *Industrial* heater



Dravo *Paraflo* heater and *Suspended Unit* heater



Dravo *Commercial* heater

ONLY DRAVO HAS ALL 4

1. **FULL LINE**—A size and type for every heating need
2. **DESIGN AND APPLICATION KNOW-HOW**
3. **NATION-WIDE SERVICE**
4. **RESEARCH**

Dravo's full line of heaters is backed by a highly trained and extensive service organization, with a reputation for dependability and thoroughness.

This is only one of the "extras" that benefit Dravo customers. The performance built into every Dravo heater is applied so that each installation functions with maximum efficiency. This is only possible because *every* Dravo technical representative *is a qualified heating engineer.*

Complete research and laboratory facilities conduct continuous studies of heater design problems. With the experience gained from over 10,000 installations, these studies result in basic improvements in all phases of both heater engineering and its application to unusual heating problems.

Make sure you get "ALL 4" when you are buying space heating. Only Dravo has the manpower, the technical background, and the facilities to assure your getting the most for your money. Write Dravo Corporation, Pittsburgh 22, Pennsylvania.

DRAVO
CORPORATION

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Parks Employ Radiant Heating, Evaporative Cooling for Baseball Fans and Players

As an epilogue to an exciting baseball season, it might be well to review some baseball news that wasn't available on the sports pages; specifically, two different approaches to customer comfort, plus a system for "warming-up" in the dugouts.

Because many of the San Francisco Giant's games will be played at night—and it is quite cool there during summer months—a radiant heating system was installed

in the 20,000-seat reserved section of their new stadium, Candlestick Park. Eagleson Engineers, of San Francisco, working with John S. Bolles, San Francisco architect, designed the heating system, which will also be used during football season, and specified more than 35,000 ft of ¾-inch dia 4-D wrought iron pipe, manufactured by A. M. Byers Co., Pittsburgh, Pa. Pipe is spaced on 18 to 48-inch centers and, as shown in first photo, is supported immediately below precast concrete seats. Headers for the combination grid and coil-type system are placed in the aisles.

Circulating water is heated by a package-type boiler, independent of the remainder of the stadium's heating plant. General contractor is Charles Harney, Inc., of San Francisco; Harry Lee Plumbing and Heating Co., Burlingame, Calif., plumbing and heating contractor, fabricated the heating coils.

Bill Veeck, colorful executive of the pennant-winning Chicago White Sox, has ordered 160 Gaffers and Sattler evaporative air coolers to make the team's Comiskey Park more comfortable for the fans. According to the manufacturer, Utility Appliance Corp., Los Angeles, the entire battery of evaporative coolers, under good conditions, could lower the temperature from 10 to 15 degrees in the stands. If weather conditions were unfavorable, the 15,000-cfm units would still provide a breeze that would make persons more comfortable. This installation will make the sports site one of the first air-cooled outdoor areas in the nation.

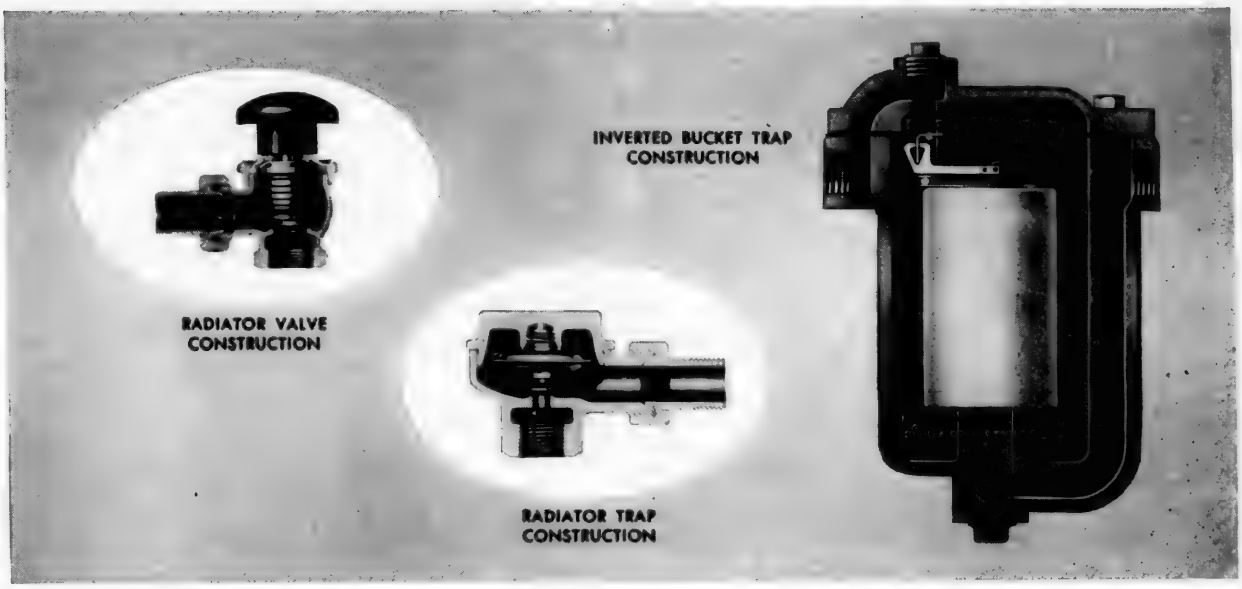
More news from Comiskey Park concerns the installation of 10 radiant heat panels, five in the home team dugout and five in that of the visiting teams. Club owners and park maintenance crews long have sought some satisfactory method of warming the dugouts so players would be comfortable on the cool and damp days and nights so common during the spring and fall weeks of the baseball season.

Panels, manufactured by Arvin Industries, Inc., Columbus, Ind., are similar to those employed by the company in its portable radiant heat screen introduced about two years ago. Each panel is 2 ft wide, 4 ft long, and about ½-inch thick. Heat is provided by an aluminum printed circuit which is sandwiched between two sheets of duPont Mylar. This sandwich then is bonded to a sheet of vinyl-clad steel. The printed circuit warms the vinyl which emits infra-red type rays to warm a person directly instead of the air around him. A fiber-glass

backing acts as an insulator, directing the heat out the front of the panel, and adds to the screen's rigidity. Because the aluminum circuit is sealed between Mylar sheets, the unit is shockproof even when immersed in water.

As shown in second photo, panels are bolted flush against the concrete ceiling of the dugouts so the heat rays are directed on the backs and shoulders of the players. The warmth provided also helps prevent stiffening of muscles between innings. Because the panels themselves only get warm, never hot, there is no danger of anyone being burned or injured if he touches them. On cold days the players can warm their hands quickly by holding them directly against the panels.

25″ Vacuum to 150 lbs. Pressure... You'll Find it in DUNHAM-BUSH Steam Heating Specialties



It's a hefty jump from 25″ vacuum to 150 lbs. pressure. But it gives you an idea of the complete scope of quality Dunham-Bush Steam Heating Specialties.

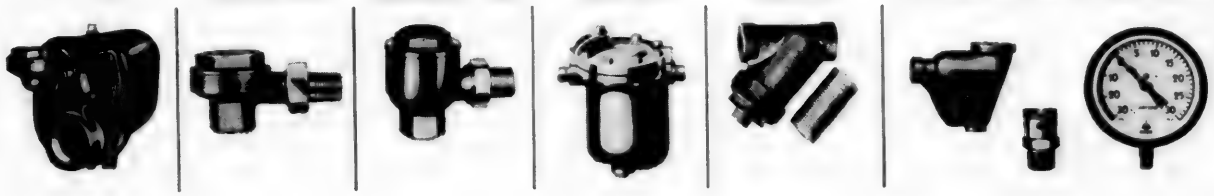
Name a steam heating specialty and Dunham-Bush has it!

You know steam heating specialties, but do you know the advantages of dealing with "one source–one responsibility"... Dunham-Bush?

If not, it'll pay you to write for free brochure #1501 and/or the name of your nearest Dunham-Bush sales engineer.

PART OF THE DUNHAM-BUSH LINE . . .

F & T TRAP | RADIATOR TRAP | THERMOSTATIC TRAP | BUCKET TRAP | STRAINERS | AIR ELIMINATOR AND AIR CHECK GAUGES



Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA
MARSHALLTOWN, IOWA • RIVERSIDE, CALIFORNIA
SUBSIDIARIES

DEGREE-DAYS FOR SEPTEMBER, 1959

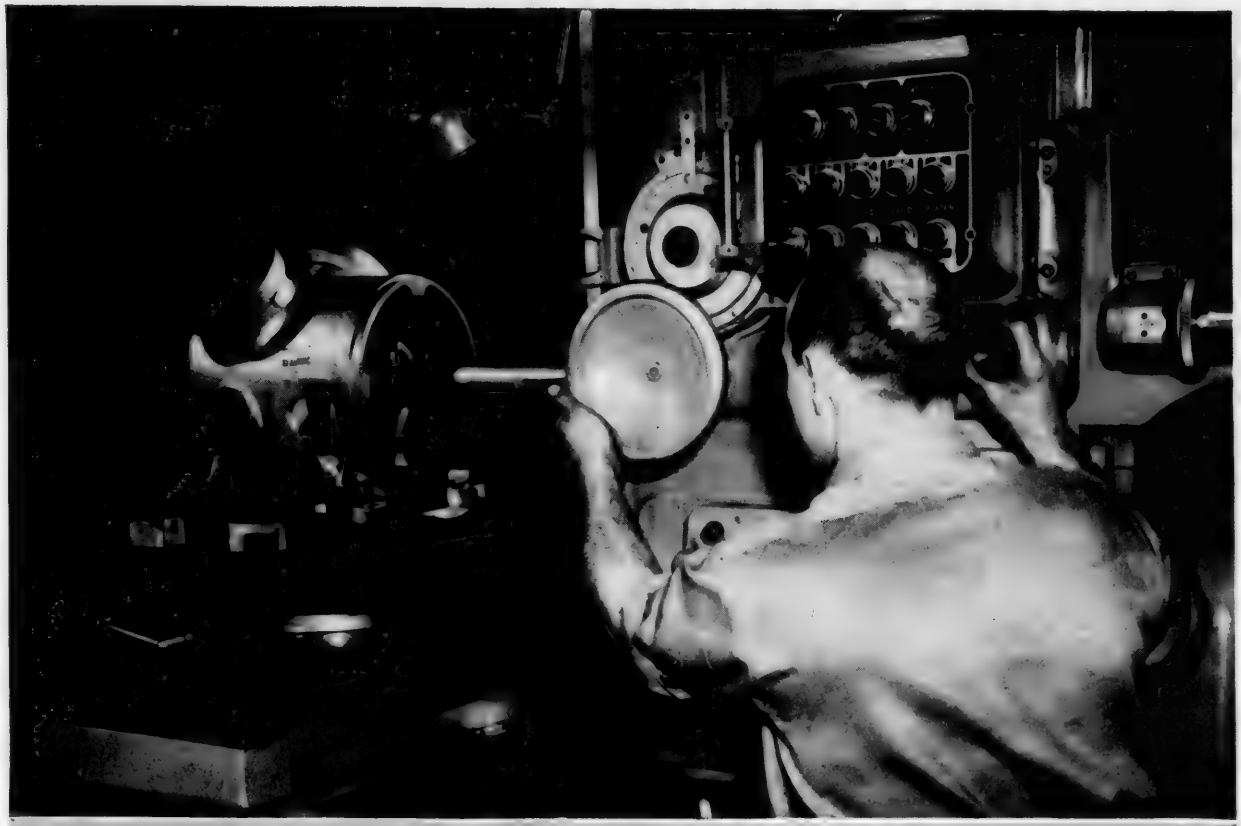
(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 32nd Year of Publication of Monthly Degree-Day Data

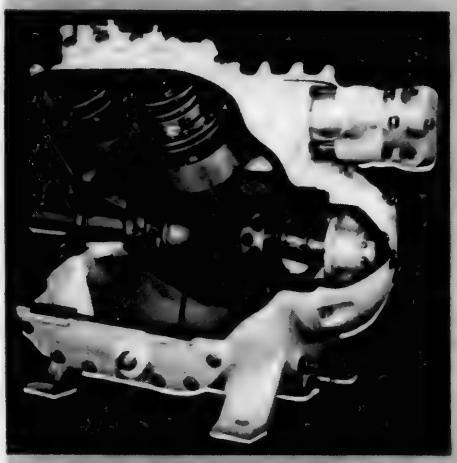
City	September			Season to Sept. 30, incl., from Sept. 1		
	1959	1958	Normal	1959	1958	Normal
Abilene, Texas (A)	(a)	6	5	(a)	6	5
Albany, New York (A)	143	142	139	143	142	139
Albuquerque, New Mexico (A)	20	35	10	20	35	10
Alpena, Michigan (C)	228	201	215	228	201	215
Anchorage, Alaska (A)	514	552	510	514	552	510
Asheville, North Carolina (C)	21	41	50	21	41	50
Atlanta, Georgia (A)	(a)	0	(a)	8	0	(a)
Atlantic City, New Jersey (C)	39	62*	29	39	62*	29
Augusta, Georgia (A)	1	1	0	1	1	0
Baltimore, Maryland (C)	28	21	29	28	21	29
Billings, Montana (A)	251	162	194	251	162	194
Binghamton, New York (C)	91	155	141	91	155	141
Birmingham, Alabama (A)	1	0	13	1	0	13
Bismarck, North Dakota (A)	273	185	227	273	185	227
Block Island, Rhode Island (A)	73	86	88	73	86	88
Boise, Idaho (A)	212	143	135	212	143	135
Boston, Massachusetts (A)	79	84	77	79	84	77
Buffalo, New York (A)	111	125	122	111	125	122
Burlington, Iowa (A)	82	82	83	82	82	83
Burlington, Vermont (A)	177	191	172	177	191	172
Cairo, Illinois (C)	2	18	28	2	18	28
Charleston, South Carolina (C)	0	0	0	0	0	0
Charlotte, North Carolina (A)	2	2	7	2	2	7
Chattanooga, Tennessee (A)	1	8	24	1	(a)	24
Cheyenne, Wyoming (A)	298	203	241	298	203	241
Chicago, Illinois (A)	62	67	90	62	67	90
Cincinnati, Ohio (C)	29	22	42	29	22	42
Cleveland, Ohio (A)	78	86	75	78	86	75
Columbia, Missouri (A)	45	48	62	45	48	62
Columbia, South Carolina (A)	1	3	0	1	3	0
Columbus, Ohio (C)	54	54	59	54	54	59
Concord, New Hampshire (A)	174	182	192	174	182	192
Concordia, Kansas (C)	85	50	55	85	50	55
Dallas, Texas (A)	0	0	0	0	0	0
Denver, Colorado (A)	191	106	120	191	106	120
Des Moines, Iowa (A)	131	77	99	131	77	99
Detroit, Michigan (A)	92	98	96	92	98	96
Devils Lake, North Dakota (C)	331	258	276	331	258	276
Dodge City, Kansas (A)	56	48	40	56	48	40
Dubuque, Iowa (A)	148	130	149	148	130	149
Duluth, Minnesota (C)	270	279	277	270	279	277
Elkins, West Virginia (A)	115	145	122	115	145	122
El Paso, Texas (A)	0	16	0	0	16	0
Ely, Nevada (A)	342	227	228	342	227	228
Escanaba, Michigan (C)	200	230	247	200	230	247
Evansville, Indiana (A)	22	39	59	22	39	59
Fairbanks, Alaska (A)	642	660	612	642	660	612
Fargo, North Dakota (A)	226	174	215	226	174	215
Fort Smith, Arkansas (A)	0	14	9	0	14	9
Fort Wayne, Indiana (A)	83	106	107	83	106	107
Fort Worth, Texas (A)	0	0	0	0	0	0
Fresno, California (A)	6	2	0	6	2	0
Galveston, Texas (C)	0	0	0	0	0	0
Grand Junction, Colorado (A)	138	62	36	138	62	36
Grand Rapids, Michigan (A)	109	151	144	109	151	144
Green Bay, Wisconsin (A)	187	194	183	187	194	183
Greensboro, North Carolina (A)	26	21	29	26	21	29
Greenville, South Carolina (A)	3	3	10	3	3	10
Harrisburg, Pennsylvania (A)	59	62	69	59	62	69
Hartford, Connecticut (A)	107	136	101	107	136	101
Havre, Montana (C)	310	226	270	310	226	270
Helena, Montana (A)	351	263	320	351	263	320
Houston, Texas (C)	0	0	0	0	0	0
Huron, South Dakota (A)	188	117	149	188	117	149
Indianapolis, Indiana (A)	54	77	79	54	77	79
Jackson, Mississippi (A)	0	0	0	0	0	0
Juneau, Alaska (A)	408	521	480	408	521	480
Kansas City, Missouri (A)	44	25	44	44	25	44
Knoxville, Tennessee (A)	0	0	0	0	0	0
La Crosse, Wisconsin (A)	156	117	152	156	117	152
Lander, Wyoming (A)	297	193	244	297	193	244
Lewiston, Maine (O)	171	185	165	171	185	165

(a) Data not available.
* Figures based on Airport readings.
Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively. [Table concluded on page 118]



THE COMPRESSOR FOR QUIET AIR CONDITIONING



Cut-away of B&G Compressor shows highlights of construction. All B&G Package Liquid Coolers and Condensing Units are equipped with this new-design compressor.

In the B&G Compressor, creative designing, plus precision manufacture, has established an entirely new standard of performance... smoother, quieter, with minimum vibration. This new conception of compressor design creates a unit basically superior because it is basically simpler.

The photograph above illustrates one of the precision manufacturing operations. A machine specially designed and built for the purpose bores and faces compressor crankcases with extreme accuracy. In fact, all the tolerances from one end of the compressor to the other add up to an incredibly small figure. All major parts are made in the B&G plant...resulting in a compressor unmatched for efficiency and smooth operation.

A B&G Compressor seldom needs servicing but when it does, usually all the parts needed can be carried in two hands. All units have *one* bore diameter...the piston and rod assembly and valve and cylinder assembly will handle 95% of all repairs.

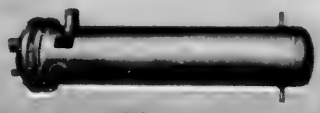
Send for complete specification and application data on B&G Air Conditioning and Refrigeration Equipment.

BELL & GOSSETT
COMPANY
Dept. RFY-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

A FULL LINE OF REFRIGERATION AND AIR CONDITIONING "PACKAGES" AND COMPONENTS

B&G Package Liquid Cooler



B&G Evaporator

B&G Centrifugal Pump

B&G Condenser

Degree-Days for September, 1959 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 32nd Year of Publication of Monthly Degree-Day Data

City	September			Season to Sept. 30, incl., from Sept. 1		
	1959	1958	Normal	1959	1958	Normal
Lincoln, Nebraska (C)	109	45	79	109	45	79
Little Rock, Arkansas (A)	0	10	10	0	10	10
Los Angeles, California (C)	0	0	17	0	0	17
Louisville, Kentucky (A)	11	23	51	11	23	51
Lynchburg, Virginia (A)	37	34	49	37	34	49
Macon, Georgia (A)	4	0	0	4	0	0
Madison, Wisconsin (A)	137	137	137	137	137	137
Marquette, Michigan (C)	204	208	236	204	208	236
Memphis, Tennessee (A)	0	12	17	0	12	17
Meridian, Mississippi (A)	0	0	0	0	0	0
Milwaukee, Wisconsin (A)	117	133	134	117	133	134
Minneapolis, Minnesota (A)	152	108	157	152	108	157
Moline, Illinois (A)	100	93	96	100	93	96
Montgomery, Alabama (A)	0	0	0	0	0	0
Nashville, Tennessee (A)	0	16	22	0	16	22
New Haven, Connecticut (A)	69	98	93	69	98	93
New Orleans, Louisiana (C)	0	0	0	0	0	0
New York, New York (C)	40	39	39	40	39	39
Newark, New Jersey (A)	39	37	47	39	37	47
Norfolk, Virginia (A)	10	7	9	10	7	9
North Platte, Nebraska (A)	198	110	120	198	110	120
Oak Ridge, Tennessee (C)	0	22	0	0	22	0
Oakland, California (A)	25	16	76	25	16	76
Oklahoma City, Oklahoma (A)	24	17	12	24	17	12
Omaha, Nebraska (A)	115	52	88	115	52	88
Parkersburg, West Virginia (C)	44	55	56	44	55	56
Peoria, Illinois (A)	66	72	86	66	72	86
Philadelphia, Pennsylvania (C)	28	33	33	28	33	33
Phoenix, Arizona (A)	0	0	0	0	0	0
Pittsburgh, Pennsylvania (C)	56	64	56	56	64	56
Pittsfield, Massachusetts (A)	180	222	213	180	222	213
Pocatello, Idaho (A)	(a)	174	183	(a)	174	183
Portland, Maine (A)	181	210	199	181	210	199
Portland, Oregon (C)	114	71	85	114	71	85
Providence, Rhode Island (A)	101	108	107	101	108	107
Pueblo, Colorado (A)	134	61	74	134	61	74
Raleigh, North Carolina (A)	23	23	10	23	23	10
Rapid City, South Dakota (A)	260	127	193	260	127	193
Reading, Pennsylvania (C)	43	57	57	43	57	57
Red Bluff, California (A)	14	3	0	14	3	0
Reno, Nevada (A)	244	155	165	244	155	165
Richmond, Virginia (A)	36	24	33	36	24	33
Rochester, New York (A)	126	140	133	126	140	133
Roswell, New Mexico (A)	14	38	8	14	38	8
Sacramento, California (C)	12	3	17	12	3	17
St. Joseph, Missouri (A)	73	44	49	73	44	49
St. Louis, Missouri (C)	25	28	38	25	28	38
Salt Lake City, Utah (A)	170	116	88	170	116	88
San Antonio, Texas (A)	0	0	0	0	0	0
San Diego, California (A)	0	0	24	0	0	24
Sandusky, Ohio (C)	61	67	66	61	67	66
San Francisco, California (C)	73	39	110	73	39	110
Sault Ste. Marie, Michigan (A)	231	273	298	231	273	298
Savannah, Georgia (A)	0	0	0	0	0	0
Scranton, Pennsylvania (A)	94	157	115	94	157	115
Seattle, Washington (C)	167	105	134	167	105	134
Sheridan, Wyoming (A)	296	210	239	296	210	239
Shreveport, Louisiana (A)	0	0	0	0	0	0
Sioux City, Iowa (A)	142	74	128	142	74	128
Spokane, Washington (A)	311	226	205	311	226	205
Springfield, Illinois (A)	56	59	56	56	59	56
Springfield, Missouri (A)	32	49	61	32	49	61
Syracuse, New York (A)	115	133	117	115	133	117
Toledo, Ohio (A)	98	117	102	98	117	102
Topeka, Kansas (C)	63	49	42	63	49	42
Trenton, New Jersey (C)	48	54	55	48	54	55
Tulsa, Oklahoma (A)	14	18	18	14	18	18
Utica, New York (O)	91	157	182	91	157	182
Valentine, Nebraska (A)	235	130	145	235	130	145
Walla Walla, Washington (C)	126	82	93	126	82	93
Washington, D. C. (C)	33	23	32	33	23	32
Wichita, Kansas (A)	41	35	32	41	35	32
Williston, North Dakota (C)	321	227	261	312	227	261
Winnemucca, Nevada (A)	276	198	180	276	198	180
Yakima, Washington (A)	207	192	150	207	192	150

For footnotes, see page 116.

NEW! improved CCVS

SUPERIOR FEATURES

- Vertical close-coupled pump and motor unit bolted to receiver.
- Cast iron receiver for long wear.
- Low return inlets for convenient piping of return close to floor.
- Two receiver inlets on side and top of receiver.
- Stainless steel motor shaft prevents corrosion.
- Quiet operation is proof of vertical pump design.
- Installation on floor level or in pit.
- Mechanical shaft-seal eliminates all leakage from pump shaft.
- No close clearance, efficiency is maintained even at 3500 RPM motor speed.
- Completely assembled ready for return and discharge connections.

There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

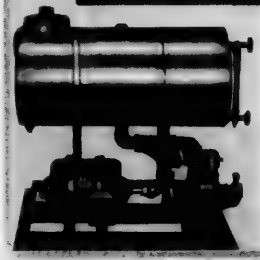
Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

Write for *Bulletin No. 19-A*

TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

Write for *Bulletin No. 14-A*



TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

Write for *Bulletin No. 17*

Call the nearest Skidmore representative or write for bulletin 21-C.

Representatives in All Principal Cities

SKIDMORE PUMPS

SKIDMORE CORPORATION ST. JOSEPH, MICHIGAN

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available

COMMERCIAL KITCHEN PLANNING—Seminar on commercial kitchen planning at Michigan State University, East Lansing, Mich. Ralbern H. Murray, American Gas Association, 420 Lexington Ave., New York 17, N. Y. ..... **NOVEMBER 9-13, 1959.**

I-B-R MEETING—Semi-annual meeting of The Institute of Boiler and Radiator Manufacturers, at the Seaview Country Club, Absecon, N. J. Secretary of the Institute, 60 E. 42nd St., New York, N. Y. ..... **NOVEMBER 9-13, 1959.**

BRI FALL CONFERENCE—Building Research Institute Fall Conference at Shoreham Hotel, Washington, D. C. Program on November 17 devoted to new heating techniques. Harold Horowitz, Assistant Director for Technical Programs, Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. ..... **NOVEMBER 16-19, 1959.**

ASME ANNUAL MEETING—Annual meeting of the American Society of Mechanical Engineers, Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary, O. B. Schier, II, 29 W. 39th St., New York 18, N. Y. ..... **NOVEMBER 29-DECEMBER 4, 1959.**

CHEMICAL INDUSTRIES EXPOSITION—27th Exposition of Chemical Industries, sponsored by the American Chemical Society, at the Coliseum, New York. Secretary of the Society, 1155 Sixteenth St., N.W., Washington 6, D. C. **NOVEMBER 30-DECEMBER 4, 1959.**

WARM AIR HEATING CONVENTION—Annual convention of the National Warm Air Heating and Air Conditioning Association, at the Chase Hotel, St. Louis, Mo. J. M. Martin, managing director of the Association, 640 Engineers Bldg., Cleveland 14, Ohio. ..... **DECEMBER 1-4, 1959.**

ASHRAE MEETING—Semi-annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, and the 2nd Southwest Heating and Air-Conditioning Exposition, sponsored by ASHRAE, in Dallas, Tex. The meeting will be at the Baker and Adolphus Hotels, and the Exposition in the Memorial Auditorium. Secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **FEBRUARY 1-4, 1960.**

ISA INSTRUMENT-AUTOMATION EXHIBIT—ISA Instrument-Automation Conference and Exhibit, at the Houston Coliseum, Houston, Tex. W. H. Kushnick, executive director, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **FEBRUARY 1-5, 1960.**

LUBRICATION SYMPOSIUM—ASME Lubrication Symposium, at the Engineering Societies Building, New York, N. Y. Secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. ..... **MARCH 14-15, 1960.**

FIRST NATIONAL ELECTRIC HOUSE HEATING EXPOSITION, sponsored by the National Electrical Manufacturers Association, at the Sherman Hotel, Chicago. R. D. Smith, secretary of the Association, 155 East 44th St., N. Y. 17, N. Y. .... **MARCH 21-23, 1960.**

AMERICAN POWER CONFERENCE—22nd annual American Power Conference, sponsored by Illinois Institute of Technology, in cooperation with many technical societies and educational institutions, at the Hotel Sherman, Chicago, Ill. R. A. Budenholzer, conference director, Mechanical Engineering Department of the Institute, 3300 Federal St., Chicago 16, Ill. ..... **MARCH 29-31, 1960.**

GAMA MEETING—Annual Meeting of the Gas Appliance Manufacturers Association, at The Greenbrier, White Sulphur Springs, West Va. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. ..... **MARCH 30-APRIL 1, 1960.**

NUCLEAR CONGRESS—Sixth Nuclear Congress, sponsored by the Engineers Joint Council and the Instrument Society of America, to be held in New York City. Headquarters to be announced later. Director of Technical and Educational Services, ISA, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **APRIL 3-8, 1960.**

(Concluded on page 122)

Airsan Viro Crimp

HIGH VELOCITY AIR FILTERS

VIRO CRIMP MEDIA
has special Hemmed Edges for strength and safe, easy handling. No Cuts! No Scratches! No Filter surface damage.

AFI MEMBER AIR FILTER INSTITUTE

MAXIMUM EFFICIENCY AT (300 — 600 FPM)

MINIMUM RESISTANCE

NO DIRECT AIR PASSAGE

LARGE DUST HOLDING CAPACITY

Also Available . . .
Low Velocity and Grease Filters.
Write for catalogs and prices.

Air Filter Corporation
4554-S W. WOOLWORTH AVE., MILWAUKEE 18, WIS.
Canadian Representative
DOUGLAS ENGINEERING CO., LTD., TORONTO

A few distributorships available.
Write for details!

you can be sure of quality . . . craftsmanship with

AGITAIR® REGISTERS and GRILLES

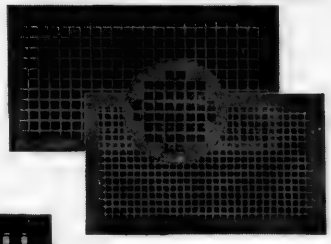
AGITAIR registers and grilles are available in a wide range of sizes and styles to meet every requirement of the architect and designer.

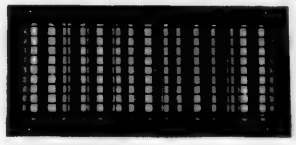
Available in all aluminum, stainless steel, bronze, brass, standard steel and plated finishes. Finish thoroughly baked on hard. Will not chip. When you specify these AGITAIR units, you are specifying quality items.

Ask your AGITAIR representative for your copy of this 32 page catalog or write to Air Devices Inc.

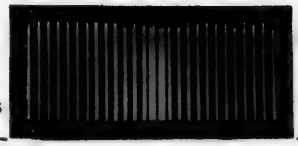
SIGHT TIGHT GRILLES

PLAIN LATTICE GRILLES





REGISTERS



GRILLES

AIR DEVICES INC.
185 MADISON AVE. • NEW YORK 16, N. Y.
BETTER PRODUCTS FOR
AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

YOU CAN BUY AIR FILTERS WITH CONFIDENCE FROM MEMBERS OF . . .

The Air Filter Institute

AFI MEMBER

Box 9325, Washington 5, D. C.

Air Devices, Inc.
185 Madison Avenue
New York 16, New York

Air Filter Corporation
4554 W. Woolworth Avenue
Milwaukee 18, Wisconsin

Air-Maze Corporation
25000 Miles Road
Cleveland 28, Ohio

American Air Filter Co., Inc.
215 Central Avenue
Louisville 9, Kentucky

Continental Air Filters, Inc.
2520 Helm Street
Louisville, Kentucky

Dollinger Corporation
11 Centre Park
Rochester 3, New York

Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey

Fram Corporation
Providence 16, Rhode Island

Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota

Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 3, Ohio

Pittsburgh Plate Glass Company
Fiber Glass Division
One Gateway Center
Pittsburgh 22, Pennsylvania

Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin

*Technical Filter Co.
2719 South Poplar Avenue
Chicago 8, Illinois

Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania

Vortex Company
121 S. Alexander Avenue
Claremont, California

Westinghouse Electric Corporation
Sturtevant Division
Hyde Park, Boston 36, Massachusetts

*Formerly Wilson & Co., Inc.

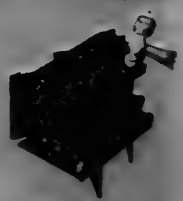
Another CAINS

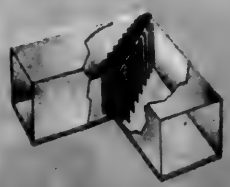
COIL OF PROFIT

INSTANT-VANE RAIL

ELIMINATES

Layout—Tab Cutting—Hole Punching—Spot Welding—Riveting—Etc. Results in a Savings Up to 75% over old methods.





Best method ever devised for installing Turning Vanes (single or double) in sq. elbows. In coils. Pull out, shear off—insert vanes and pean with hammer. No valuable time lost.

CAIN MANUFACTURING, INC.
Birmingham, Alabama
1111 North 5th Ave. Phone FA 2-0354

(Concluded from page 120)

OHI EXPOSITION AND CONVENTION—23rd National Oil Heat and Air Conditioning Exposition, at the New York Coliseum, held concurrently with the 28th annual convention of OHI, at the Park-Sheraton Hotel, New York City. Secretary, Oil Heat Institute of America, Inc., 500 Fifth Ave., New York 36, N. Y. ..... **APRIL 4-7, 1960.**

BRI SPRING CONFERENCE—Building Research Institute Spring Conference at Statler Hilton Hotel, New York, N. Y. Harold Horowitz, Assistant Director for Technical Programs, Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. ..... **APRIL 19-21, 1960.**

ASME-SAM CONFERENCE—ASME-SAM Management Conference, at the Statler Hilton Hotel, New York, N. Y. Secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. ..... **APRIL 21-22, 1960.**

WELDING SOCIETY MEETING—41st Annual Meeting and Welding Exposition of the American Welding Society in Los Angeles Calif. Headquarters to be announced later. A. L. Phillips, secretar of the Society, 33 W. 39th St., New York 18, N. Y. ..... **APRIL 25-29, 1960**

WESTERN EXPOSITION—Third Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference, Shrine Exposition Hall, Los Angeles, Calif. F. J. Tabery, exhibit manager, 3443 S. Hill St., Los Angeles 7, Calif. Exhibit sponsored by Western Air Conditioning Industries Association. ..... **APRIL 27-30, 1960.**

METAL EXPOSITION & CONGRESS—2nd Southwestern Metal Exposition & Congress, at State Fair Park, Automobile Building, Dallas, Tex. C. L. Wells, exposition manager, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. ..... **MAY 9-13, 1960.**

ISA CONFERENCE AND EXHIBIT—ISA Instrument-Automation Conference and Exhibit, at Brooks Hall, San Francisco, Calif. W. H. Kushnick, executive director of the Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **MAY 9-13, 1960.**

DESIGN ENGINEERING SHOW—ASME Design Engineering Conference and Show, at the Statler Hilton Hotel, New York, N. Y. Secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. ..... **MAY 23-26, 1960.**

NDHA MEETING—Annual meeting of the National District Heating Association, at Grove Park Inn, Asheville, N. C. Secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 6-9, 1960.**

ASHRAE MEETING—Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at Royal York Hotel, Vancouver, B. C., Canada. Secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **JUNE 13-15, 1960.**

CONGRESS ON OCCUPATIONAL HEALTH—13th International Congress on Occupational Health, first to be held in the Western Hemisphere, at the Waldorf Astoria Hotel, New York City. Dr. Leo Wade, organizing committee, 15 W. 51st St., New York 19, N. Y. ..... **JULY 25-29, 1960.**

ASTM MEETING—Annual meeting of the American Society for Testing Materials, at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. ..... **JUNE 26-JULY 1, 1960.**

ISA EXHIBIT AND MEETING—ISA Instrument-Automation Conference and Exhibit, in conjunction with the 15th annual meeting, at the Coliseum, New York, N. Y. W. H. Kushnick, executive director, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **SEPTEMBER 26-30, 1960.**

Here's the LOW COST Answer to the Hot Water Problem for Coin-operated Laundries, Restaurants, Motels, Schools, Clinics, Apartments, Small Plants

Ewing HEAVY-DUTY AUTOMATIC COMMERCIAL

Uses Any Type Gas

Vertical—Requires So Little Floor Space!

No Expensive Storage Tanks Needed!

Low Original Cost!
Economical Operation!
Trouble-Free Operation!
Simple To Install!
Automatic Controls!

Write or wire for prices and complete details

Hot Water Heater

Provides a constant, plentiful supply of 180 degree HOT WATER! Automatic TROUBLE-FREE operation! Compact! . . . Quickly and easily installed . . and ABSOLUTELY SAFE! Amazingly efficient and economical. Ask a Ewing user what he thinks of his Ewing heater.

THREE SIZES:—190,000—315,000—520,000 BTU input. Recovery capacities up to 500 gallons per hour at 100 degree temperature rise. Storage capacities 50 to 145 gallons. Inside surfaces treated with metal protective to assure long life and clean, clear water. Heavy duty magnesium rod incorporated with each unit.

Constructed in accordance with requirements of A.S.M.E. Boiler and Pressure Code. Each heater is registered with National Board of Boiler and Pressure Inspectors. All Safety controls listed by AGA.

Ewing MANUFACTURING CO.
2545 NW 10 P. O. BOX 875
OKLAHOMA CITY, OKLA.

ARCHITECT:
Frazier, Raftery, Orr & Fairbank, Geneva, Ill.

CONSULTING ENGINEER:
Wm. A. Gavelek, Elgin, Ill.

CONTRACTOR:
A. J. Ironsides Heating & Ventilating, Elgin, Ill.

WHOLESALER:
Inland Supply Company, Elgin, Ill.

Battery of B&G Universal Pumps used to circulate chilled water through cooling system. No vibration eliminators or flexible connections are needed.

B&G BOOSTERS SERVE DUAL PURPOSE

One PD35 Booster is used to circulate hot water for heating and cold water for cooling in building connecting plant and office; one 2" Booster circulates boiler water through fuel oil preheater.

PUBLISHING HOUSE COOLED *QUIETLY* WITH B & G PUMPS

The Church of the Brethren at Elgin, Illinois, publishes numerous religious papers. In the office and factory of this organization, the 300 ton cooling load of the two buildings is handled with chilled water, circulated by four B&G Universal Pumps. Two additional Universals are used as condenser water pumps.

Universal Pump motors are specially constructed and selected for *extra quiet* operation. Long *sleeve* bearings are used in both motor and pump—another assurance of smooth vibrationless operation and long life. The oversized shaft is made of special alloy steel with an integral heat-treated thrust collar to absorb end-thrust. Water leakage is prevented by the diamond-hard "Remite" Mechanical Seal—a B&G development.

Note, too, that vertical split case construction with removable bearing frame permits easy servicing without breaking pipe connections or motor leads.

BELL & GOSSETT
COMPANY
Dept. FY-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Keep pace with your space . . .

CYCLOTHERM

provides for

tomorrow's heating today

The Cyclotherm you install today will meet your steam requirements for many years to come. But time does fly and businesses do grow. And when you make a plant addition 18 Cyclotherm models, with 18 different boiler horsepowers, are ready to match new space with new heating capacity.

The Cyclotherm Steam and Hot Water Generator is built under one roof with one manufacturing responsibility backing the entire equipment—shipped fire-tested and ready to operate. Up to ⅓ smaller than other package generators of same capacities and needing no excavation, no foundation, no costly stack.

Electronic controls operate the Cyclotherm automatically. On units of 80 HP or more, modulation controls regulate firing rate from 30% to 100% of rated capacity without loss of efficiency. Smaller models automatically *off* when steam demands are satisfied, automatically *on* when more steam is needed. Operation stops if firing sequence is interrupted and unit fails safe. Cyclotherm cuts maintenance costs by up to 50%.

Cyclotherm meets all state requirements, conforms to A.S.M.E. and National Board standards, carries Underwriters' Laboratories label. Burns oil and/or gas. Steam generators: 15 to 750 HP. Hot water Generators: 670,000 to 6,700,000 BTU per hr.

At the Frederick Leighton School, Oswego, N. Y., two 100 HP Cyclotherms keep 21 classrooms and 550 pupils warm and comfortable. Building designed by Ketcham-Miller-Arnold Architects of Syracuse, N. Y.; Consulting Engineer Cedric R. Acheson, also of Syracuse.

YEARS AHEAD IN STEAM & HOT WATER GENERATION

CYCLOTHERM®

Steam & Hot Water Generators

Division of National-U.S. Radiator Corp.
56 E. First St., Oswego, N. Y.

Clip to Your Letterhead:

56

Please send me full information about Cyclotherm Steam and Hot Water Generators.

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

HEAT EXCHANGERS

Prepared by engineers of The Patterson-Kelley Company, East Stroudsburg, Pa., this book on Heat Exchangers supplies information to aid an engineer in ordering the proper heat exchanger for a specific process application. The information presented can be applied to shell and tube exchangers of any manufacture.

Standard combinations of tubes, heads, and shells are discussed, as well as the array of material from which each may be fabricated. Every listing of components or combinations is made in the order of cost, as an aid to economical selection.

The end product of the book is a heat exchanger inquiry data sheet. When the suggested information is supplied, it permits any of the heat exchanger manufacturers to bid competitively on a unit.

Heat Exchangers. Hard covers, spiral binding, 8½ x 11 inches. Published by The Patterson-Kelley Co., Inc., East Stroudsburg, Pa. Available by company letterhead request (with title) to qualified engineers engaged directly in the design and procurement of process heat exchangers for chemical, food, or other processing applications.

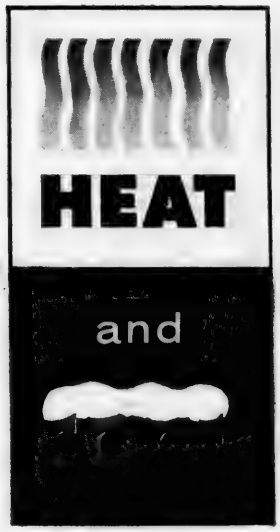
OFFICES IN THE SKY

So many accept the modern office building in the same casual manner that one does the automobile, the television set or the automatic washer. Therefore, an engineer may be startled by the fact that office building design and construction had to go through a period of development before such structures as those of Rockefeller Center in New York City, the new buildings of the Triangle in Pittsburgh, and the large buildings that make up the skyline of major cities, were possible.

Offices in the Sky, by Earle Shultz and Walter Simmons, with a foreword by Clarence B. Randall of the Board of Inland Steel Company, makes fascinating reading, particularly to one who is interested in the various development stages of the office skyscraper which is so much a part of major American cities. While not a technical book, it does provide good reading for the engineer.

Offices in the Sky, by E. Shultz and W. Simmons. Cloth bound, 5¾ x 8¼, 328 pages. Published by Bobbs-Merril Co., Inc., Indianapolis, Ind. Price, $6.

NOISE CONTROL IN BUILDINGS—During January, 1959, a conference was held in New York City by the Building Research Institute on Noise Control in Buildings. A number of papers and panel discussions were arranged, grouped around the general subjects of fundamentals of noise control in buildings, control of transmitted sound, elimination of noise in air conditioning and other mechanical equipment, and unsolved problems in sound transimission and noise control. A paper bound, 136-page report (Publication 706), contains the papers presented and the panel discussions. Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. Price, $5.



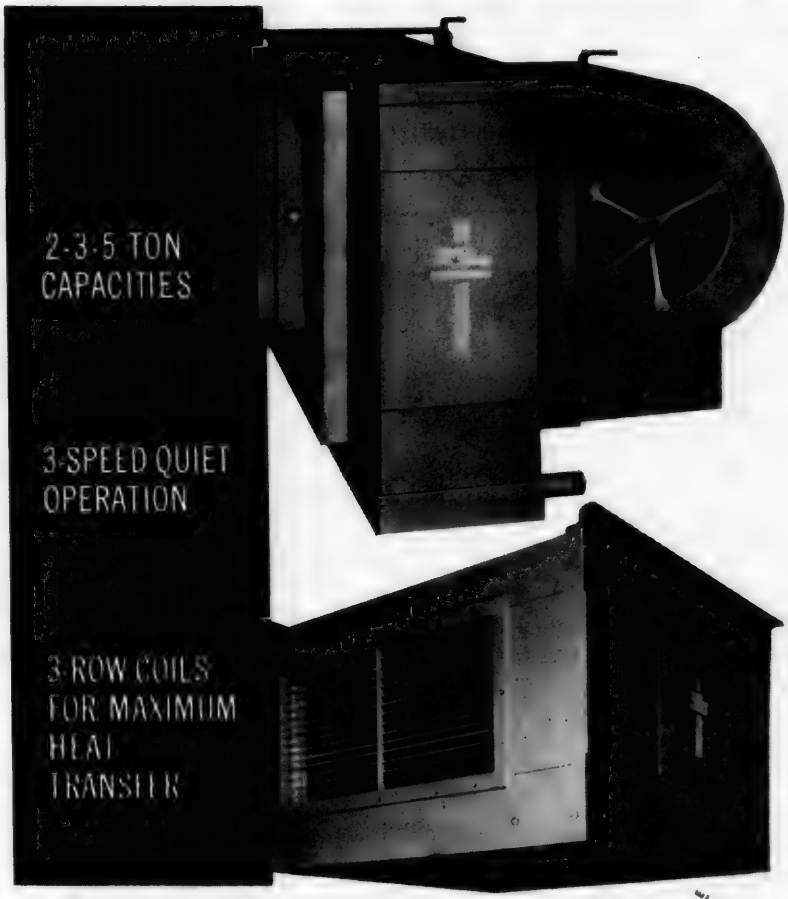
you can both with these large capacity

McQuay SEASONMAKERS

These extremely popular large capacity McQuay Seasonmakers enable you to provide year 'round comfort at any desired temperature level . . . heated, filtered air in cold months, and cooled, dehumidified, filtered air in warm months . . . when used with a hot or chilled central water supply.

They are particularly designed for commercial or residential applications where a direct air distribution system is necessary, or for use in medium to large areas requiring 2, 3 or 5 tons capacity. Units are also available for refrigerant operation.

You'll like the 3-speed, quiet operation and the double drain pan with ½" insulation for protection against sweating and the auxiliary drain pan to catch condensate from the control or shutoff valve. In fact, you'll like everything about these McQuay Seasonmakers. For complete information, see your McQuay representative, or write McQuay, Inc., 1619 Broadway Street N. E., Minneapolis 13, Minnesota.



Write for catalog No. 721 for complete selection and capacity information.

McQuay Means Quality

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

Quickdraft...THE WORLD'S SAFEST

POWER DRAFT UNIT FOR INDUSTRIAL, RESIDENTIAL AND INSTITUTIONAL EXHAUSTING

Increases heating and combustion efficiency!

Provides air power for bulk materials handling!

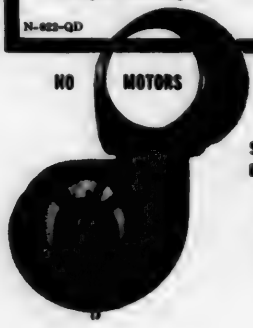
Exhausts corrosive gases and abrasives!

Quickdraft provides industry, commerce, institutions and homebuilders *power draft* engineered for economical and efficient combustion regardless of building or atmospheric conditions. Models suitable for every heating or incinerator application . . . eliminate pulsating or chattering, puffing, smoking and sooting. Reduce building costs, no tall, unsightly stacks required. Quickdraft also provides industry with ¼ inch to 60 inches W.G. static pressure for exhausting corrosive gases, abrasives and paint spray. Heavy-duty, high-pressure models, 6 inches to 30 inches diameter, are available for moving bulk materials or anything that can be moved by air. Because there are no motors, fans or bearings in exhaust line, only Quickdraft avoids costly clogging, corrosion of moving parts or fan failure.

IMPORTANT NOTICE

For withstanding corrosive gases, all Quickdraft units are available in standard acid resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P.V.C.) and with plastic and Fiberglas coatings.

N-823-QD



NO MOTORS FANS OR BEARINGS IN EXHAUST LINE

Send for QUICKDRAFT ENGINEERING DATA on your application . . . now.

Quickdraft CORPORATION

P.O. Box 87—O Canton 1, Ohio

WHAT READERS SAY

Duct Pressure Calculation

EDITOR, AIR CONDITIONING, HEATING AND VENTILATING:

Referring to Mr. James W. May's article, How to Calculate Pressure Regain in a Duct System in your September issue, I should like to add the following comments:

Pressure loss coefficients used in the six examples are not representative, especially since total pressure drop is considerably higher through an expanding than through a contracting transition fitting of comparable geometrics.

As for procedure, air horsepower and fan selection would require only system total pressure drop, not a detailed tabulation of static pressure variations caused by changes in duct velocity. However, such information on static pressure changes is essential for determining pressure available at take-offs for obtaining design air flow in branch ducts. Since even relatively small systems may have 90% or more of their outlets installed in branch ducts, the significance of static pressure loss or regain cannot be over-estimated.

Total pressure (*TP*) and static pressure (*SP*) losses coincide as long as duct velocity remains unchanged (friction, elbows). They differ when velocity changes occur due to change in duct area, flow rate or both (transitions, flow-through fittings). As shown in Fig. 1, in such cases, a moderate (total pressure) loss may be accompanied by a severe drop in static pressure (B-C) or a considerable *TP* loss by static pressure regain (D-E). Of course, there is never regain in total pressure. Consequently, location of a branch duct take-off would be satisfactory upstream of B (high static pressure) and completely ineffective at D (static pressure below atmospheric zero).

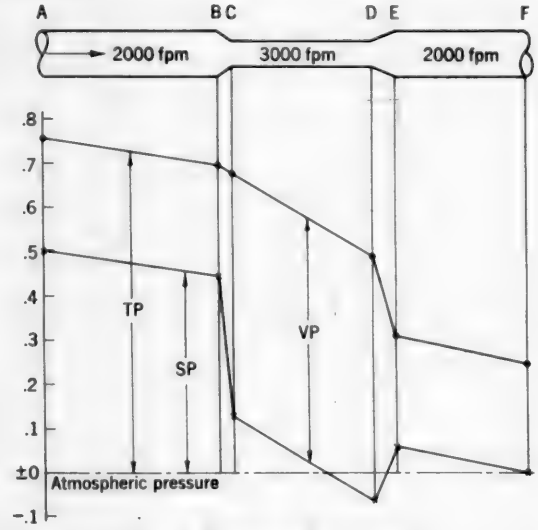


Fig. 1. Pressure profile for duct.

Thus, when loss coefficients are used, it is important to know whether they refer to total or static pressure and to which velocity pressure (*VP*) or velocity pressure differential they must be applied.

Static pressure loss and regain may, however, be derived by adaptation of total pressure coefficients, for instance:

(a) For velocity rise through gradually contracting transition:

Total pressure loss: $TP_U - TP_D = K\,VP_D$
Static pressure loss: $SP_U - SP_D = (1 + K)\,VP_D - VP_U$

(b) For the velocity drop through a gradually expanding transition:
Total pressure loss: $TP_U - TP_D = C\,(VP_U - VP_D)$
Static pressure regain: $SP_D - SP_U = (1 - C)\,(VP_U - VP_D)$

where the subscripts U and D refer to upstream and downstream, and K and C are loss coefficients available in the literature.

For greater simplicity in design and elimination of graphic methods of duct static calculation, regain and loss values have been tabulated in the writer's article, *Rapid Design of High Velocity Ducts* in the September, 1958 issue of this magazine, Tables 1 and 6. Design procedure and work sheet for finding sectional and cumulative static pressure changes for each duct section were also provided.

To illustrate the difference in approach, the conditions shown in Fig. 1 may be calculated:

(a) on the basis of *TP* loss and *SP* derived therefrom, and (b) on the basis of *SP* loss and regain.

(a) Total Pressure Drop Method

Section	Velocity	Velocity Pressure	Friction Loss	Transition C_{TP}*	Transition TP Loss	Section TP Loss	Cumulative TP Loss	SP (TP_{cum} — VP)
F	2000	.25	—	—	—	—	.25	0.
EF	2000	.25	.06	—	—	.06	.31	.06
DE	30° (Transition)	—	—	.59	.183	.183	.493	−.067
CD	3000	.56	.18	—	—	.18	.673	.113
BC	45° (Transition)	—	—	.04	.022	.022	.695	.445
AB	2000	.25	.06	—	—	.06	.755	.505

*For contracting transition, multiply C_{TP} by downstream VP. For expanding transition, multiply C_{TP} by VP differential. (See ASHAE Guide, 1959, pp. 291-2, Table 4 and formulae 9, 11.)

(b) Static Pressure Drop and Regain Method

Section	Velocity	Friction Loss	SP Transition Loss*	SP Transition Regain*	Section SP Drop	Cumulative SP drop
EF	2000	.06	—	—	.06	.06
DE	30° (Transition)	—	—	.136	−.136	−.076
CD	3000	.18	—	—	.18	.104
BC	45° (Transition)	—	.34	—	.34	.444
AB	2000	.06	—	—	.06	.504

System TP = cumulative SP losses at A + initial VP = 504 + .25 = .754 in. w.g.

*See Rapid Design of High Velocity Ducts, Tables 1 and 6.

(Concluded on page 128)

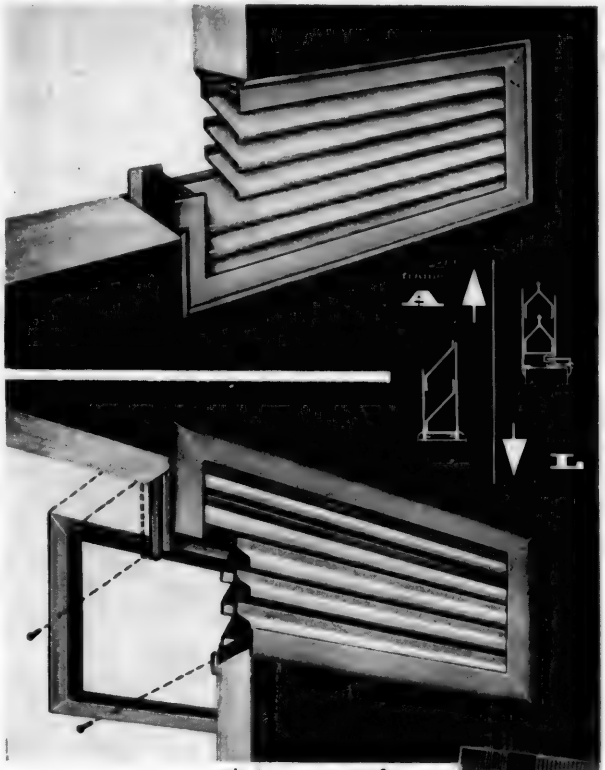
NEW EXTRUDED ALUMINUM
C/S DOOR LOUVERS

superb quality
rugged construction
competitively priced

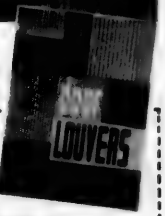
This new C/S Louver is a precision engineered product that is neat, attractive, and practical. It is competitive with sheet metal assemblies yet has many attractive qualities available only in extrusions. C/S mass production facilities make possible off-the-shelf shipment and stock item pricing.

Two blade styles and two frame sizes simplify door louver selection. The A Frame louver uses traditional wood molding. The L Frame louver is supplied with a matching extruded interior trim frame that quickly and securely clamps the louver in the door opening.

Five louver types are available: sight-proof, light proof, vertical line, sound absorbent, and standard. They are available in mill finish aluminum, etch and clear lacquer, anodized or prime coat for field painting.



write for new catalog
— Complete specifications, stock sizes, technical information, and typical installation illustration.



C/S CONSTRUCTION SPECIALTIES, INC. DEPT. AV-1159
55 Winans Avenue, Cranford, New Jersey

Please send C/S Door Louver
☐ literature ☐ specifications
☐ name of local representative so that we may inspect product sample

name_____
firm_____ title_____
address_____

That's right LOOK AGAIN

here's why the THERMOSTAT in Sterlco® TRAPS does more for you...

ALL TRAPS are NOT ALIKE

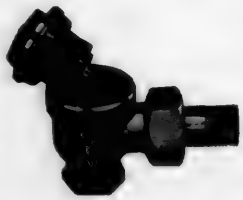
1. If the thermostat is damaged, the spring action closes the trap. Trouble is immediately located because radiation becomes cold — no waste of steam — no searching. Thermostats and seats easily replaced.

2. It compensates for pressure changes — operates satisfactorily even if pressures vary.

3. It cannot be damaged by excessive steam pressures or by freezing.

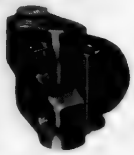
STERLCO THERMOSTATIC RADIATOR TRAPS

Keep radiators clear of condensate without wasting steam. Sturdy bronze bodies and covers—replaceable seats. Angle, Straightway, Corner or Vertical styles.

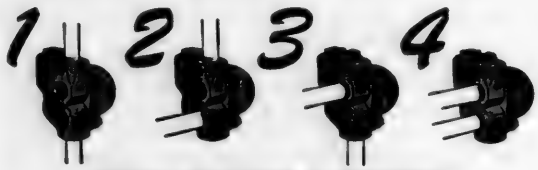


STERLCO FLOAT and THERMOSTATIC TRAPS

Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes Sterlco F & T's outstanding performers on unit heaters and other steam heating equipment.



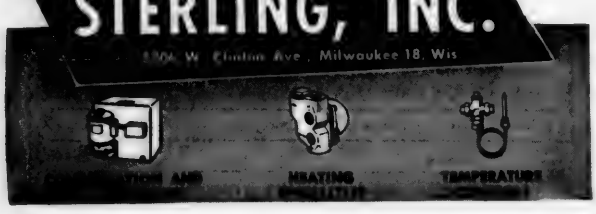
Install the ¾" 69B in the most convenient way



STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE.

Sterlco Products Distributed through LEADING HEATING and PLUMBING WHOLESALERS

STERLING, INC.



(Concluded from page 127)

Results are seen to be very close, with small differences due to variations in transition loss factors employed There can be little doubt that method (b) is simpler and less time consuming.

Elliot Godes
Research Engineer
Anemostat Corporation of America
Hartford, Conn.

Mr. Godes is quite correct in stating that the pressure drop is greater through an expanding than through a contracting transition fitting of the same geometry, and I called attention to this fact in the first paragraph of my article.

Mr. Godes' interest seems to be primarily in devising a rapid method for design of the duct system and that is understandable. The intent of my article, however, was to illustrate the pressure relationships in a duct system and how regain was accomplished, and no attempt was made to choose precise coefficients because that type of information is generally available in handbooks and so forth.

For those somewhat unfamiliar with pressure regain in a duct system, I felt that a plot of the pressure relationship at various points in the system would prove of interest.

James W. May
Director of Technical Training
American Air Filter Co., Inc.
Louisville, Ky.

Canadian Degree-Days for September, 1959*

City	September		Cumulative	
	1959	Normal	1959	Normal
Calgary, Alta.	517	410	517	410
Charlottetown, P. E. I.	220	240	220	240
Crescent Valley, B. C.	429	330	429	330
Edmonton, Alta.	481	440	481	440
Fort William, Ont.	319	370	319	370
Grande Prairie, Alta.	504	450	504	450
Halifax, N. S.	156	190	156	190
London, Ont.	147	150	147	150
Medicine Hat, Alta.	360	300	360	300
Moncton, N. B.	245	260	245	260
Montreal, P. Q.	152	190	152	190
North Bay, Ont.	265	320	265	320
Ottawa, Ont.	181	200	181	200
Penticton, B. C.	243	200	243	200
Prince George, B. C.	501	460	501	460
Quebec City, P. Q.	250	290	250	290
Regina, Sask.	414	370	414	370
St. John, N. B.	275	360	275	360
Saskatoon, Sask.	449	380	449	380
Timmins, Ont.	346	410	346	410
Toronto, Ont.	121	154	121	154
Vancouver, B. C.	253	220	253	220
Victoria, B. C.	313	230	313	230
Windsor, Ont.	95	120	95	120
Winnipeg, Man.	307	311	307	311

* These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

BRIEFLY STATED NEWS ITEMS

L. L. Denson, formerly senior mechanical engineer with B. M. Dornblatt & Associates, New Orleans, La., has announced the establishment of a mechanical engineering practice as consulting engineer for design, investigation and appraisal, industrial and commercial, at 211 Delta Building, 348 Baronne St., in the same city.

BURGEONING BUSINESS

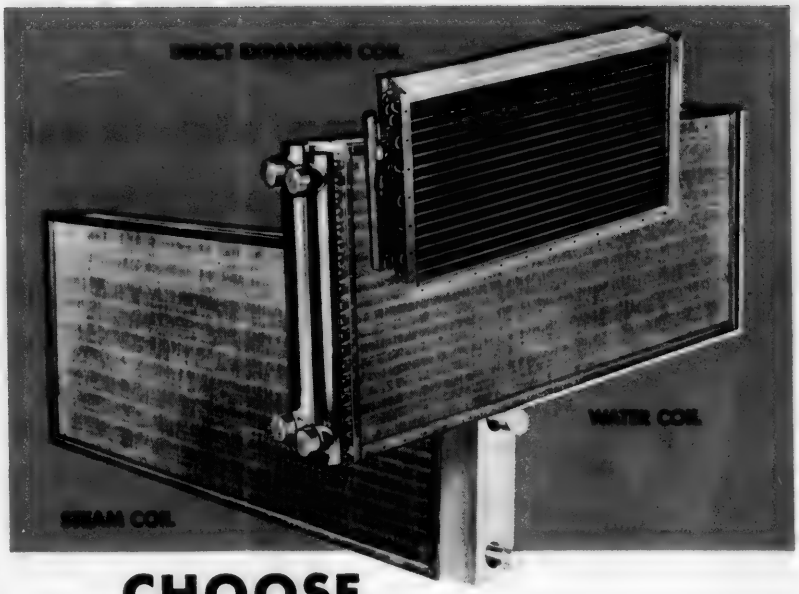
STODDARD INDUSTRIES, manufacturer of the Dust-magnet electrostatic air filter for furnaces and air conditioners, has moved its offices from Chicago to 3383 East Layton Ave., Cudahy, Wis. The company recently opened a new factory in Clarendon, Ark., and is now consolidating its sales and general offices in its Cudahy plant to take advantage of expanded production and operating facilities. . .

The Correct-Air conditioner for pulpits and crane cabs, formerly the Dravo air conditioner, is now being manufactured and sold by JAMES CAMPBELL SMITH, INC., and its subsidiary company, CORRECT-AIR CORPORATION, both of Willoughby, Ohio. James Campbell Smith, Inc., builds pulpits and crane cabs, also. . .

WARREN WEBSTER & CO., INC. is opening a new area sales office at the home office and factory of the company, 17th and Federal Streets, Camden, N. J. Raymond H. Wolf, appointed manager of the office, states that the new installation will merge sales offices in Philadelphia, West Jersey, Trenton and Wilmington (Del.). The company's entire line of high and low pressure steam specialties, radiation, unit heaters, and air conditioning products will be handled from the new office by the same sales personnel formerly in the other locations. . .

Creation of an AIR CONDITIONING AND HEATING DIVISION is announced by WELBILT CORP., New York, N. Y.

(Continued on page 131)



CHOOSE BOHN KNOWN-CAPACITY COILS

ALL BOHN COILS are ruggedly built . . .

- Die-formed plate-type aluminum fins . . . from 4 to 14 per inch . . . with self-spacing collars completely covering the tubes. Permanent, tight, metal-to-metal fin-tube bond.
- Heavy-gauge casings die-formed from galvanized steel.
- Headers of heavy-wall seamless copper tube with heavy die-formed end caps. High pressure tested at 320 psig. minimum air pressure under warm water.
- Tested and rated according to ASRE-ASHAE standard 33-58.

IN ADDITION . . .

DIRECT EXPANSION COIL (1), Type DE, insures equal distribution of refrigerant with brass pressure-type distributors;

WATER COIL (2), in Types WH, WF, and WD, is drainable in every type;

STEAM COIL (3), in Types S, NFS, and NFO, has condensing tubes pitched in casing a minimum of ⅛" per foot of tube length, as well as orificed steam supply tubes, and coil tubes floating free within coil casing to prevent stress and strain on tubes and joints . . . maximum operating pressure 200 psig. at 400° F.

"Buddy Bohn" reminds you:

"We are one of the largest manufacturers of specially designed evaporators and condensers for Original Equipment Manufacturers of refrigeration and air conditioning units and systems."

For full information, call or write to Bohn

BOHN *Buy the known line . . . the BOHN line*

Aluminum and Brass Corporation

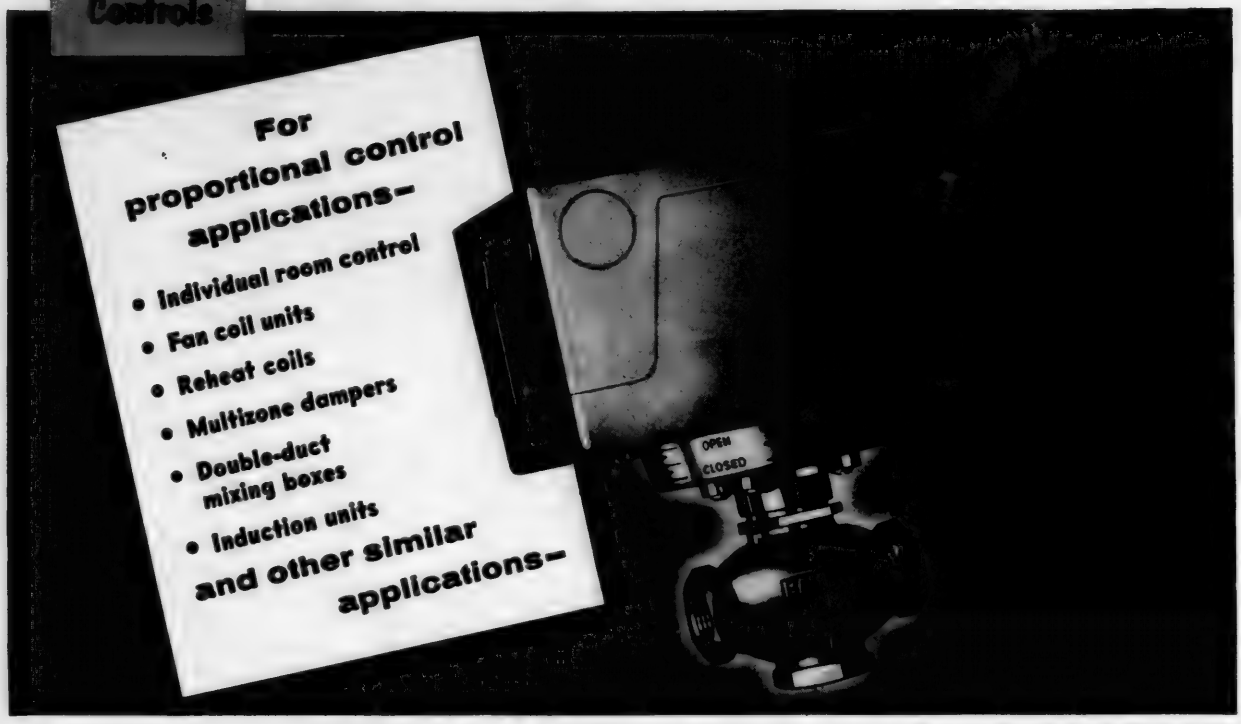
Danville Division, Danville, Illinois

BARBER COLMAN

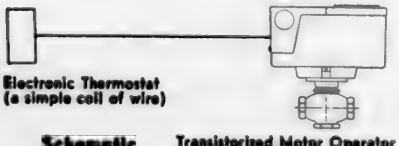
Automatic Controls

NEW!

A Transistorized Electronic Motor Operator



–with lever for air damper control



Schematic — Transistorized Motor Operator (no tubes or relays)

Transistors eliminate tubes and relays giving you the benefits of electronic control at no extra cost

Now for the first time, electronic system control is available at a cost comparable with "standard commercial equipment."

The transistor operator is an electronically controlled device containing a transistorized amplifier and an operating mechanism designed for proportional operation of a valve or damper.

Virtually self-contained, the simple attachment of a two-wire sensing element to the operator forms a system of electronic control (see schematic).

Check these "plus features":

- Simplified, compact unit through the use of transistors.
- Long, trouble-free performance and low maintenance through the elimination of tubes and relays. All moving parts operate submerged in oil.
- Simplifies installation because of compactness and self-contained design.
- Spring return action provides fail-safe performance. Operator returns to "off" position in case of power failure.
- Operator can be easily converted from direct to reverse acting.

Call your Barber-Colman representative or write today for brochure F8991.

BARBER-COLMAN COMPANY

Dept. W, 1301 Rock Street, Rockford, Illinois • Field Offices in Principal Cities

(Continued from page 129)

Peter Dalton, formerly product sales manager for Worthington Corporation's Air Conditioning Division, will head the new division with the title of sales manager. Products include residential air-cooled equipment and air- and water-cooled equipment for industrial and commercial use. Heating equipment will include gas-fired and oil-fired forced air furnaces. Distribution will be exclusively through franchised dealers and wholesalers until, at a later date, a national account department will be formed. . .

Two Hupp Corporation divisions, TYPHOON AIR CONDITIONING COMPANY, Brooklyn, N. Y., and TYPHOON HEAT PUMP COMPANY, Tampa, Fla., will now operate under uniform sales policies which will permit distributors and dealers of either line to handle the other under the same conditions. Typhoon distributors and dealers now have a broad line of both packaged air conditioners and in heat pumps.

PERMUTATIONS-COMBINATIONS

Effective October 1, the former Peerless Electric Co., Warren, Ohio, became PEERLESS ELECTRIC DIV., H. K. PORTER CO., INC. H. K. Porter is a Pittsburgh-based diversified industrial concern. Peerless, founded in Warren in 1893, is a major supplier of custom built electric motors to the original equipment market as well as an important manufacturer of fans, blowers, and ventilating equipment for commercial and industrial applications. Further expansion into the manufacture of other air moving equipment and electric motors requiring special design and manufacture is planned. Ralph Kroehle, chairman of the board of Peerless, will continue with Porter as a consultant. S. C. Powers, who has been president, will continue as division general manager. . .

CALUMET & HECLA, INC., Chicago, Ill., is buying FLEXONICS CORP., Maywood, Ill. Flexonics makes flexible metal hose, synthetic hose products, expansion joints, etc. Calumet & Hecla fabricates non-ferrous metal tube and parts, operates copper and uranium mines, and has extensive lumbering operations. . .

CRANE CO., Chicago, Ill., acquired by purchase all properties and assets of The Chapman Valve Mfg. Co., Indian Orchard (Springfield), Mass. This will give the company manufacturing facilities in the East, something it has not had since 1941 when its Bridgeport, Conn., plant was sold. The plant, which will be known as The Chapman Valve Mfg. Co., is a wholly-owned subsidiary of Crane Co. It will retain its present management and executive staff, headed by C. Goodwin Carter. Plans for the plant include manufacture of present line of all products now manufactured by Chapman for which there is an adequate demand. . .

As a result of a merger effective October 1, BRUNER CORPORATION of Milwaukee and Los Angeles will operate as a wholly owned subsidiary of HAGAN CHEMICALS AND CONTROLS, INC., Pittsburgh, Pa. Bruner will continue to distribute its water softeners, filters, and other water conditioning equipment exclusively through the plumbing trade.

NEW REPRESENTATIVES

The Philadelphia branch office of THE MERCOID CORPORATION is now located at 628 Davisville Road, Willow Grove, Pa. A complete line of controls, relays and mercury switches are carried in stock. . .

Edward Leposwsky, Flushing, N. Y., now represents the FIELD CONTROL DIV., H. D. CONKEY & CO., Mendota, Ill., in Greater New York and Long Island. Available is a complete line of draft controls for every fuel and application. . .

Five sales representative appointments announced by PACIFIC STEEL BOILER DIV., NATIONAL-U.S. RADIATOR CORP., Johnstown, Pa., include, to cover the nine far western counties in Virginia, The O. M. Jones Co., Johnson City, Tenn.; also R. P. Fedder, Rochester, N. Y., for the Rochester area; Wilson-Brinker Associates, Inc., Kalamazoo, Mich., for western Michigan; Heet-Flo Co.,

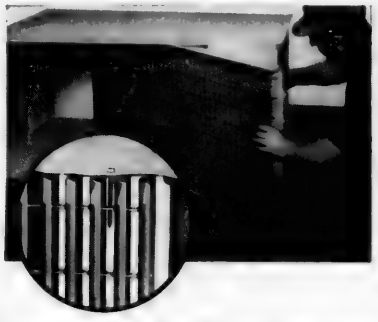
How Barber-Colman Airturns pay off

You can save space and money by using Barber-Colman Airturns to guide air around corners in duct systems.

They minimize pressure losses, too. Extensive laboratory and field studies show that pressure drops in square elbows with Airturns are less than 20% of the velocity head. This equals the performance of space-consuming, long-radius elbows without vanes. It is superior to the performance of any other factory-made units available. It is two to four times better than the performance of contractor-fabricated vanes studied.

Cost is in favor of Airturns. Installation is less than that of long-radius elbows. Factory mass production results in modest initial cost. And, the cost of call-backs often is reduced by improved system performance.

When you add up all the benefits, Barber-Colman Airturns pay off well. They are available cut to size, ready to install, or in 48″ x 48″ slabs.



For complete details, call your local Barber-Colman Air Distribution field office, or write for literature.

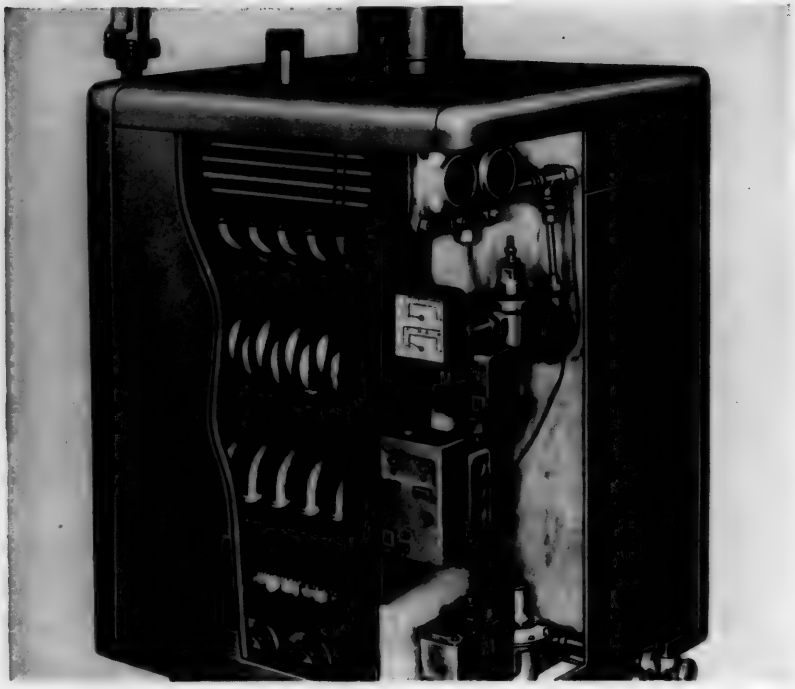
BARBER COLMAN

Uni-Flo

ENGINEERED AIR DISTRIBUTION

BARBER-COLMAN COMPANY

Dept.W,1102 Rock Street, Rockford, Illinois



Here's an Efficient, Economical Water Heater. Oil or Gas Fired

No matter how small or how large your requirements, there's a Bryan Indirect water heater engineered to meet your specific hot water needs. Utilizing the Indirect "heat exchanger" method, the Bryan water heater . . .

Provides low cost hot water. The heat exchanger—constructed of heavy gauge copper tubing—is placed in the hot boiler water, absorbs the heat, transferring it to the water flowing through the heat exchanger tubes. Result: a highly efficient water heating system that's. . .

Economical. Since service water does not come into contact with high temperature boiler heating surfaces, there is little danger of scale or corrosion. Thus, maintenance and replacement costs are greatly reduced, and unit continues to perform at maximum efficiency.

Compact. Bryan Indirect water heaters require a minimum of valuable floor space. For example, the model shown, which has an input of 125,000 BTU's, requires only 25" x 23" floor space.

Capacities from 120 gallons to 2160 gallons per hour at 100° rise.

Bryan Indirect water heaters are designed and built to the requirements of the A.S.M.E. code. Gas Fired Models A.G.A. approved.

For information about the specific heater best suited to your requirements, write Bryan Steam Corporation, Peru, Indiana, for catalog.

BRYAN STEAM CORP. • Peru, Ind.

Briefly Stated

Los Angeles, Calif., for the Los Angeles area; and Mason & Barry, Inc., Charleston, W. Va., for West Virginia. . .

Appointment of five manufacturer's representatives to handle products in the original equipment manufacturer and mobile refrigeration fields has been announced by the YORK DIV., BORG-WARNER CORP., York, Pa. This marketing of components is a major departure for a firm that has used most or all of its production in its own complete systems and products. Included in the sales program will be compressors and condensing units for original equipment manufacturers; truck refrigeration systems for central automotive distributors and automotive compressors for car manufacturers and independent manufacturers of complete automotive air conditioning systems.

UP ON TOP

H. W. Rainey, Jr., has been appointed general sales manager of the STURTEVANT DIVISION OF WESTINGHOUSE ELECTRIC CORP., Hyde Park, Mass. He had been field sales manager for three years. A graduate of Georgia Tech with a degree in mechanical engineering, Mr. Rainey joined B. F. Sturtevant Company, which was acquired by Westinghouse in 1945, as a sales engineer. . .

Lauren E. Seeley has been elected president of H. B. SMITH CO., INC., Westfield, Mass. cast iron boiler manufacturer. He succeeds Franklin A. Ferguson who has become honorary vice-chairman of the Board. Mr. Seeley joined the company in 1955 as vice-president in charge of engineering. Since 1925 he had served as engineering consultant for the company. Also, he has been Dean of Technology at the University of New Hampshire and ASHVE president in 1951. . .

Albert O'B. Andrews, appointed president of AMERICAN-STANDARD INDUSTRIAL DIVISION, Detroit, Mich., succeeds John W. Brennan, who will engage in the engineering and development of the corporation's air

(Continued on page 134)

increase production capacity
improve fan and heating efficiency

gas-fired air make-up units

Pictured above is a portion of the final assembly line at Aerovent showing 8 units slated for delivery to a large Midwestern automobile accessory manufacturing plant. Designed to supply ample quantities of clean, pre-heated or cool, outside air to replace air exhausted by ventilating systems, the Aerovent Gas-Fired Air Make-Up Unit keeps air fresh; eliminates drafts and negative pressures. Safe, dependable operation and automatic, semi-automatic or manual control with natural, mixed, manufactured or propane gas.

For winter or summer use, these compact, packaged units are available in four unit arrangements and four sizes from 36" to 54" for various capacities, BTU ratings and pressure conditions.

Write for bulletin 880.

OTHER UNITS AVAILABLE FOR STEAM OR HOT WATER

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent

FAN COMPANY, INC.

Ash and Brandt Streets Piqua, Ohio

MERCURY-TO-MERCURY SWITCH
requires no service—contacts never pit, burn or corrode.
PERMANENT ALNICO MAGNET
links water level with electrical controls; prevents failure of mechanical linkages.
CORROSION-RESISTANT FLOAT
is made of 304 Stainless Steel for long, trouble-free service. Can also be made of special materials for extreme local conditions.
NO-SCALE FLOAT CHAMBER LINER
"flexes" off scale; prevents float "sticking".

Here's "Low Maintenance"

BOILER SAFETY

MAGNETROL

BOILER WATER LEVEL CONTROLS

"Blow-down" the float chamber once-a-shift; inspect the switches once a month—that's all you have to do to keep a Magnetrol in tip-top *safe shape.* It's made that way. The secret is all in the simple magnetic operating principle *as pioneered and perfected by Magnetrol.*

A magnetic sleeve, raised and lowered within a nonmagnetic tube, attracts or repels an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

Standard Magnetrol Units are available for pressures to 600 psi and temperatures to 750°F., for single or multi-stage control with as many as three separate switching actions. Also special units for more extreme requirements. For full details, mail coupon.

MAGNETROL, Inc.

MAGNETROL, INC., 2106 S. Marshall Blvd., Chicago 23, Ill.
Please send Catalog Section III with full information about Magnetrol Boiler Water Level Controls. 10

Name_____

Company_____

Address_____

City_____ Zone____ State_____

for FUME

CONTROL

install

FLEXAUST®

HOSE

Made of strong neoprene coated cotton or nylon fabrics spiral wire reinforced.
For *all* kinds of fume and dust control, and ventilation uses.
Extremely flexible, durable, and lightweight.
Exceptionally easy to cut, install, connect, reuse, and relocate.
Sizes 1¼" thru 36" i.d.

Write for details today
Distributors in all principal cities

THE FLEXAUST COMPANY
Dept. HV-11
[illegible] PARK AVE., NEW YORK 17, N. Y.

Briefly Stated

(Continued from page 132)

conditioning and related product lines, with particular emphasis on expansion of the overseas market. Mr. Andrews had been vice-president and controller. . .

Election of John D. Weber to vice-president of THE SWARTWOUT CO., Cleveland, Ohio, and manager of its AUTRONIC CONTROL DIVISION, was announced. He has been manager of marketing and manufacturing of the division for eighteen months. The division manufactures electronic instruments and controls for the chemical, petroleum, power, and atomic industries. . .

Election of George E. Fickett as vice-president and general sales manager of THE POWERS REGULATOR CO., Skokie, Ill., maker of automatic temperature controls, was announced. Mr. Fickett was formerly contract sales manager. . .

Mr. R. Lisson has been appointed manager of market research for DAVIS ENGINEERING, a division of American Metal Products Company, Elizabeth, N. J. (The company manufactures heat exchangers for the marine and stationary field.) Mr. Lisson is a licensed professional engineer and has been with Davis since 1945. In his new post, he will direct an expanded program of advertising, sales promotion and market research. Announcement was also made of the appointment of Lawrence A. Nigro as New York district sales manager. . .

William F. Dudek has been appointed manager of the Trane sales office in Seattle, Washington, THE TRANE COMPANY, La Crosse, Wis., reported. . .

The following promotions were nounced by READING TUBE CORP., New York, N. Y.; Bob Shurilla, formerly Chicago district sales manager, now assumes the duties of regional manager of the Midwest area. Bernard Roche, formerly Cleveland warehouse manager, takes

(Concluded on page 136)

NEW

SPECIFICATION BULLETIN

How to Specify:

- **Pressure Gauges**
- **Industrial Thermometers**
- **Dial Thermometers**
- **Recording Thermometers**
- **Recording Hygrometers**
- **Bi-Metal Dial Thermometers**

Engineers, architects and contractors are finding this Weksler Specification Bulletin a great time saver!

Designed for "at a glance" information and specifications on Weksler instruments most frequently specified for indicating and recording temperature, pressure and humidity, the bulletin illustrates and describes most of the basic instruments needed in air-conditioning, heating, ventilating, plumbing and piping.

WRITE FOR YOUR COPY OF THE WEKSLER SPECIFICATION BULLETIN

WEKSLER INSTRUMENTS CORP
FREEPORT, L. I., NEW YORK

28% saved on installation
11% saved in construction costs
(BASED ON 10,000 SQ. FT. BUILDING)

VENTIL-AIRE® PACKAGED ROOF-MOUNT AIR-CONDITIONING AND HEATING SYSTEM

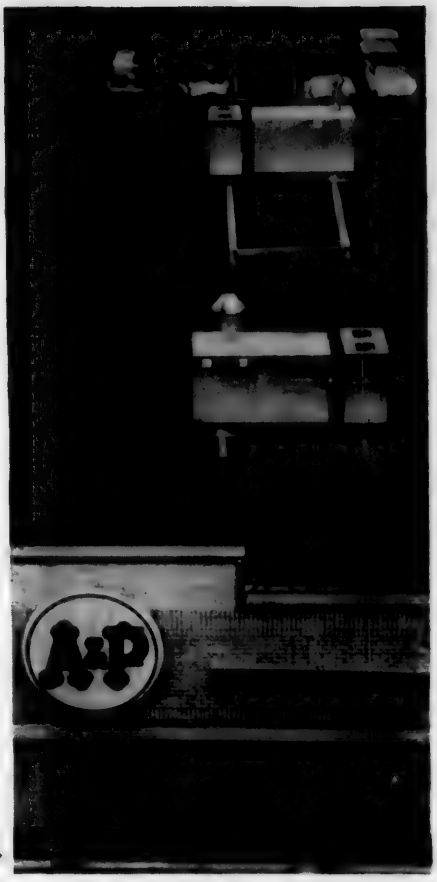
For single story commercial and industrial buildings

Ventil-Aire's air-conditioning and heating system combines all the elements of built-up systems into one compact package. Air-conditioner, air cooled condensing unit, compressor and gas or oil fired heater are combined in this single operating unit. The unit is delivered ready for installation—requiring cutting small opening through roof, connecting short duct to ceiling diffuser which is supplied and the hook-up of electrical and fuel lines.

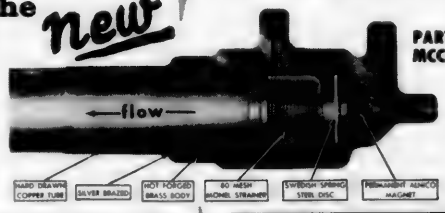
The system saves valuable floor space, money in initial cost, installation and maintenance, and delivers more cooling or heating per dollar of operation. Here is air-conditioning and heating at its best for small and large installations. Available in 5, 7½, 10, and 15 ton sizes.

Write for illustrated literature and case histories.

VENTIL-AIRE CORPORATION
1815 Decatur St. • Brooklyn 27, N. Y. • VA 1-6330



WATSCO introduces the *new* C. C. VALVE
(Capillary Control Valve)



U.S. PAT. NO. 2,646,071

A valve specifically designed for use in reverse cycle systems. The *C. C. VALVE* is installed in conjunction with the capillaries between the high and low sides of the system, to provide single capillary restriction for the cooling cycle and double capillary restriction for the heating cycle.

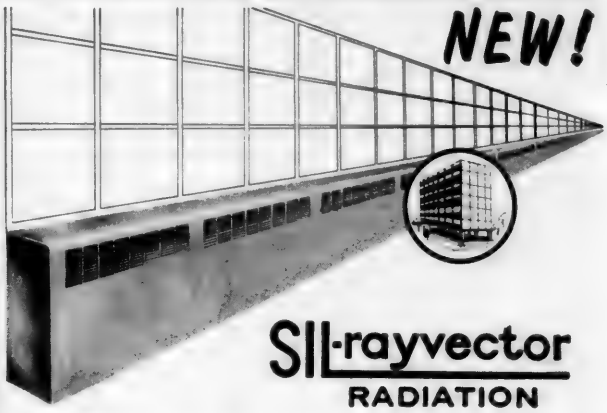
The *C. C. VALVE* is applicable to all units up to and including five tons and may be used for either single or multiple capillary installations. Flow can be regulated by the size of the capillary used.

The *C. C. VALVE* replaces two ordinary check valves, thereby cutting installation time and costs in half.

Opening sizes can be made to your specifications.

Send for Illustrated Catalog Dept. V-11

WATSCO INC.
1020 E 15th STREET • HIALEAH, FLORIDA



SIL-rayvector RADIATION

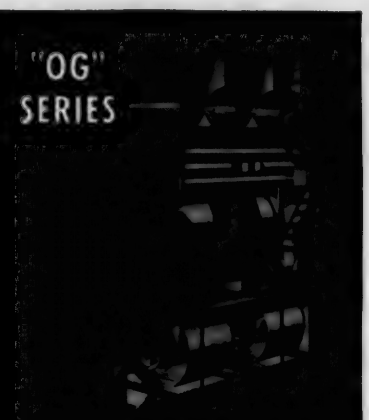
"Custom fits" without cutting . . . Slashes installation time & expense

Standardized sections up to 4' lengths. Accessories for unusual building contours. Finned tubes mounted and adjusted to required pitch in seconds on sliding cradle hangers. Elements packaged individually for easy handling. Write, wire or phone for complete catalog.

radiant-ray BRAND

radiant-ray radiation, inc.
newington, connecticut

"OG" SERIES



LENNOX

GAS... OIL... OR NEW TYPE

Dual Fuel

POWER BURNERS

Combination burners are available for the "OG-4," and are interchangeable with single fuel burners. All burners are of the same general construction; switching from dual fuel to a single fuel burner involves changing only one or two minor parts. On all burners the combustion air is pre-heated. "Push button" changeover from one fuel to another and electric gas ignition give added ease of operation and safety to the combination burners. Write today for the full story.

LENNOX Task Matched Equipment to control and condition air for industry

64,000 to 2,000,000 Btuh Units

CLIP AND MAIL FOR FREE SPEC SHEETS

LENNOX Industries Inc.
INDUSTRIAL DIVISION
Box 1294, Dept. AC-11,
Des Moines 5, Ia.

Please send me—without obligation—complete specifications and engineering data on Lennox "OG" Series Industrial Heaters

Name_____

Company_____

Address_____ City_____

Title_____

Briefly Stated

(Concluded from page 134)

over as Chicago district sales manager. . .

Victor C. Nelson, named sales manager for cooling towers and sheet metal specialties manufactured by Machinery and Systems Div., CARRIER CORP., Syracuse, N. Y., has had 22 years experience with the company, having handled construction, service, and development engineering posts in many of the division's sales offices throughout the country. . .

Three appointments are expected to greatly strengthen management at BALTIMORE AIRCOIL CO., INC., Baltimore, Md., according to John Engalitcheff, Jr., president. They are: W. Donald Geiser, production manager; George E. Klein, assistant production manager; and Thomas F. Facius, chief engineer. Mr. Geiser had been chief design engineer with the company for the past two years, Mr. Facius has been a research engineer with the company since 1953. . .

Appointment of William F. Peters as general sales manager for ANEMOSTAT CORPORATION OF AMERICA, New York, N. Y., was announced. He rejoins Anemostat after serving as New York branch manager for American Air Filter Company. Prior to his association with AAF, Mr. Peters held various positions with Anemostat since first joining the company in 1945 as a research engineer.

* * *

John I. (Jack) Trimble, 54, vice-president and general manager of Janitrol Heating and Air Conditioning Div., Surface Combustion Corp., Columbus, Ohio, passed away. A graduate of Carnegie Tech and the University of Florida, he had been associated with Surface Combustion since 1928, when he joined the engineering department in Toledo. He became a vice-president of the Corporation in 1957, and was named general manager in June of this year. He was a former member of the ASHAE Committee on Research.

JOIN TWO LENGTHS

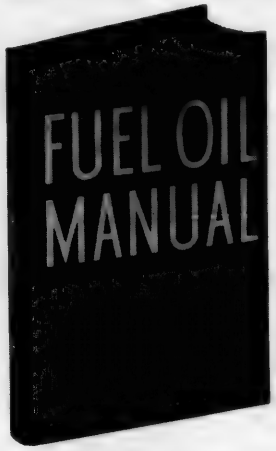
SIMPLY BY SCREWING

No more collars or clamps! Wiremold Air Duct forms a joint *as firm and strong as the duct itself.* Only Wiremold's exclusive construction makes this possible. Spiral of one length fits, snug as a screw, into spiral of other length. And, air flow is not restricted. Save job time; save odd lengths for neat use on next job. Write for full story, or ask your DISTRIBUTOR.

FOR AIR CONDITIONING / EXHAUSTING
MATERIALS HANDLING / MANY OTHER USES

WIREMOLD®
AIR DUCT

THE WIREMOLD COMPANY • HARTFORD 10, CONN.



Here is a book that will give you a comprehensive picture of the characteristics and uses of every type and grade of fuel oil. The author explains the meaning of each oily property, and shows how this information is applied to the selection, handling and burning of fuel oil. Impurities and how they effect combustion are described fully, and a special chapter describes fuel oil additives and how they are used. Another chapter lists troubles which may be encountered in using fuel oils, and shows the correct remedy to apply in each case. Technical language is avoided wherever possible and all terms are fully explained.

168 Pages **$4.50** 34 Tables

THE INDUSTRIAL PRESS

93 Worth Street New York 13, N. Y.

To order, circle letter K on postcard, last page.

Arno DUCTAPE

Fastest—Easiest Way to Seal Ducts and Apply Insulation

- Sticks instantly to anything.
- Seals airtight—holds fast.
- Vapor-proof, vermin-proof.
- Also, fire-resistant types.
- *Write for free test sample.*

ARNO ADHESIVE TAPES, INC.
4106 Ohio St., Michigan City, Ind.
Dr. Scholl's Industrial Tape Division

Elgo Ventilating Specialties

NEW! EXTRUDED ALUMINUM SHUTTERS

Shutters of modern design which give you ALL of these features: Lightweight, Full Weather Strip, Low Freight Cost, Easier Installation, Concealed Pivot Pins, Rust and corrosion Proof and Natural aluminum finish with fluted frames.

Write for complete specifications.

Free Catalog

ELGO SHUTTER & MANUFACTURING CO.
2732 W. Warren Detroit 8, Michigan

STOP WATER HAMMER

CONTROL Hydrostatic Shock

SPECIFY SHOCK CONTROL by-- HYDRO-trol
HYDROSTATIC SHOCK CONTROL

Here's the Shock Control that's been designed to provide a more efficient and permanently effective method of controlling Hydrostatic Shock and eliminating Water Hammer on every Hot or Cold Water Piping System.

Designed to last the life of the piping system without failure, . . . Hydro-Trol is constructed entirely of stainless steel. Its pressurized design utilizes the cushioning effect of both hydraulic and pneumatic pressure to provide its unmatched efficiency in absorbing and controlling the pressures of Hydrostatic Shock and resulting Water Hammer under even the most extreme conditions.

Available in six sizes, Hydro-Trol offers a Simplified Sizing Method that makes it "PLUMB-EASY" to specify and install the correct size on every job.

FOR FURTHER INFORMATION WRITE FOR YOUR COPY OF "SHOCK CONTOL BY HYDRO-TROL"

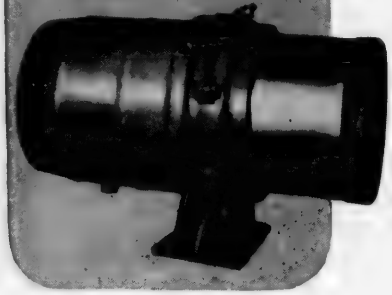
JAY R. SMITH MFG. CO.
Union, New Jersey
PLUMB-EASY

CHAIR CARRIERS DRAINS INTERCEPTORS

important points about joints

- Yarway Gun-Pakt Joints are serviced *in the line under full steam pressure.*
- Costly shutdowns eliminated.
- Maintenance records show 1 manhour per year per joint.
- Fewer expansion joints needed per length of pipeline with Gun-Pakt.

YARWAY GUN-PAKT EXPANSION JOINTS



For new Yarway Expansion Joint Catalog EJ-1916 write YARNALL-WARING CO., 104 Mermaid Avenue, Phila. 18, Pa.

go YARWAY with confidence

CLASSIFIED ADVERTISING

Sold at $12 per column inch.

WANTED

CHIEF ENGINEER—FANS

Industrial fan manufacturer looking for M.E. experienced all phases fan design for administrative position with unlimited opportunities for salary and management growth. Send resume and salary requirements. **Write Box 954, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.**

SITUATION WANTED

SHEET METAL SUPERINTENDENT

Know all phases—Layout—Cost Estimating—Assembly and Erection. Air Conditioning, Heating, Ventilation. Seeking permanent connection. Foreign or Domestic. **Write Box 54, Niles 48, Ill.**

MANUFACTURERS' AGENTS

An established manufacturer with 25 years experience producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans. The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators.

Please reply Box 914, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

WANTED

GRADUATE MECHANICAL ENGINEER: 1-2 years experience for design of industrial heating, air conditioning and fume control systems. Staff position in Engineering Department of a major midwest pharmaceutical company. Salary commensurate with abilities. **Write Box 953, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.**

PRINTED FORMS available for immediate shipment. Heating & oil burner materials form, burner service record cards, service order forms, inspection information form, survey sheet and others. Also can supply BURNER SERVICE form in 8 part EZE-SNAP with 3 carbons in each set, 1200 sets. Imprinted with your name, address and telephone, only $20.40. Send for samples—no obligation. Write Dept. AC, Degree Day Systems, 39-30 58th St., Woodside 77, N. Y.

WANTED

MANAGER NATIONAL ACCOUNT SALES

Opportunity for aggressive man about 35 with sales and sales-engineering background, with working knowledge of residential heating and air-conditioning distribution. Must be personable, have leadership qualities and have ability to directly influence sales to O.E.M. accounts and to users and specifiers in the pre-fabricated homes and government housing markets. Will spend major part of time traveling and will report directly to General Sales Manager. Good potential for advancement into top sales management exists with company nationally recognized for complete quality line. Mid-west location. Write giving background and salary requirements. Replies will be confidential. Our own people know about this advertisement. **Write Box 952, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.**

Babbitt

Adjustable

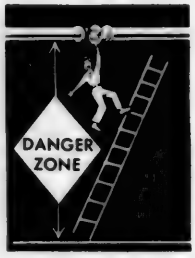
SPROCKET RIM

with Chain Guide

Changes that Danger Zone to a

SAFETY ZONE

The distance between the floor of your plant and your overhead valves is a DANGER ZONE when piled up boxes or even ladders are used to reach the valves.



Turn it into a SAFETY ZONE — equip your overhead valves with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. If your supplier does not carry them, contact us direct.

Babbitt 168-9

STEAM SPECIALTY CO.

5 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

ALPHABETICAL INDEX OF ADVERTISERS

A

Aerofin Corp. ..... *
Aerovent Fan Co., Inc. 133
Air Conditioning & Refrigeration Institute 48
Air Devices, Inc. 121
Air Filter Corp. 120
Air Filter Institute 121
Air-Maze Corp. ..... *
Airtemp Div., Chrysler Corp. 43
Alco Valve Co. 47
Allen-Bradley Co. ..... Inside Front Cover
Allen Cooler & Ventilator, Inc. ..... *
Allen, W. D., Manufacturing Co. ..... *
Allin Manufacturing Co. ..... *
American Brass Co. 15
American Gas Association 4-5
American Machine and Metals, Inc. ..... *
American Society of Heating Refrigerating and Air-Conditioning Engineers *
American-Standard Industrial Div. ..... *
Anemostat Corp. of America 46
Armstrong Machine Works 1
Arno Adhesive Tapes, Inc. 137

B

Babbit Steam Specialty Co. 138
Barber-Colman Co. 130-131
Bell & Gossett Co. 117, 123
Bethlehem Steel Co. 36
Binks Manufacturing Co. ..... *
Bohn Aluminum & Brass Corp. 129
Bridgeport Brass Co. 26-27
Bryan Steam Corp. 132
Buensod-Stacey, Inc. ..... *
Buffalo Forge Co. 25
Buffalo Pumps Div., Buffalo Forge Co. 33
Burnham Corp. 21
Burt Manufacturing Co. ..... *

C

Cain Manufacturing Co., Inc. 121
Cambridge Filter Corp. ..... *
Carrier Corp. ..... *
Chrysler Corp., Airtemp Div. 43
Clarage Fan Co. 39
Classified Advertisements 138
Cleaver-Brooks Co., Boiler Div. ..... *
Construction Specialties, Inc. 127
Coyne & Delany Co. 7
Crane Packing Co. ..... *
Cyclotherm Div., National-U. S. Radiator Corp. 124

D

Davis Engineering Corp. ..... *
DeBothezat Fans Div., American Machine and Metals, Inc. ..... *
Dravo Corp. 113
Drayer-Hanson Div., National-U. S. Radiator Corp. 108
Dunham-Bush, Inc. 115
Dwyer, F. W., Manufacturing Co. ..... *

E

Elgo Shutter & Mfg. Co. 137
Ellison Draft Gage Co. ..... *
Ewing Manufacturing Co. 122

(Continued on page 140)

IT COSTS LESS TO OWN AN INTERNATIONAL PACKAGE BOILER

The only true cost of any boiler is the *total cost* including day-to-day operation, cleaning and maintenance. In addition to unsurpassed fuel economy, International WATER TUBE Package Boilers are the easiest to maintain—an important cost advantage.

EASIEST TO CLEAN . . .

Full access is provided to *both* the fireside and waterside of all tubes. Even when neglected for long periods, only a small deposit of soot can accumulate on *top* of the tubes, and this can be quickly brushed or blown off. Obviously, any danger of untimely shutdown due to soot clogged in tubes is eliminated. With an International Package Boiler, cleaning is an occasional, simple chore . . . not a mandatory, frequent, and costly maintenance headache.

LOWEST MAINTENANCE . . .

Because of built-in quality and International WATER TUBE design, there is no possibility of *bagging, blistering or furnace burnout.* In addition, tube ends are completely submerged in water filled headers, eliminating any chance of leaky joints due to flame impingement.

Before specifying or purchasing any Package Boiler, take a close look at the *total* cost picture. No matter how you compare, you'll see that it costs less to own and operate an International Package Boiler.

Get the full details from your
INTERNATIONAL DISTRICT REPRESENTATIVE
or write for Bulletins 600 and 1400 today

IBW

BOILER BUILDERS SINCE 1886

THE INTERNATIONAL BOILER WORKS CO.

890 Spruce St. East Stroudsburg, Pa.

Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

Manufactured and sold in Canada under agreement with CANADIAN VICKERS LTD. Montreal, P. Q.

Keep Up With Recent Developments at the

2nd Southwest

HEATING & AIR-CONDITIONING EXPOSITION

(under the auspices of ASHRAE)

DALLAS, TEXAS

Feb. 1-4, 1960

Memorial Auditorium

WHEREVER your interest lies . . . industrial . . . commercial . . . institutional . . . domestic . . . you'll find this informative exposition packed with new products, new facts, and new ideas that can be put to work for you.

SEE more than 200 fact-filled displays covering recent progress in air handling and treating equipment, as well as refrigeration.

MEET more than 1000 technical representatives of the leading manufacturers in your industry.

DISCUSS with them how their new products can lead to bigger profits for you.

COMPARE and judge at first-hand the relative merits of competitive products.

DECIDE which of them can best suit your needs.

2208

2nd Southwest

HEATING & AIR-CONDITIONING EXPOSITION

Management: International Exposition Company, Inc.
480 Lexington Ave., New York 17, N. Y.

ALPHABETICAL INDEX OF ADVERTISERS

(Continued from page 139)

F

Fafnir Bearing Co. ..... *
Field Control Div., H. D. Conkey & Co. *
Flexaust Co. 134
Frick Company 35

G

Governair Corp. 11
Greenheck Fan & Ventilator Corp. ... *
Gustin-Bacon Manufacturing Co. 51

H

Halstead & Mitchell 31
Harris, Arthur & Co. ..... *
Hartzell Propeller Fan Co. ..... *
Heat-Timer Corp. 2
Henry Valve Co. .....Inside Back Cover
Hoffman Specialty Manufacturing Corp. ..... *

I

Ilg Electric Ventilating Co. ..... *
Illinois Testing Laboratories, Inc. 109
Industrial Press 142
Inland Steel Co. ..... *
International Boiler Works Co. 139
Iron Fireman Manufacturing Co. ..... *

J

Jenkins Bros. 40
Jenn-Air Products Co., Inc. ..... *
Johns-Manville 22-23
Johnson Service Co. 50

K

Kaiser, E. B., Co. ..... *

L

Lawler Automatic Controls, Inc. 32
Lennox Industries, Inc. 136

M

Magnetrol, Inc. 133
Marsh Heating Equipment Co. 24
McDonnell & Miller, Inc. .....Back Cover
McQuay, Inc. 125
Minneapolis-Honeywell Regulator Co. *

N

Nash Engineering Co. 52
National Tube Div., United States Steel Corp. ..... *
Niagara Blower Co. ..... *
Nibco, Inc. ..... *

P

Patterson-Kelley Co., Inc. 12-13
Peerless Electric, Div., H. K. Porter Co., Inc. 41
Petro 107
Porter, H. K., Co., Inc. 44
Portmar Water Heater Co., Inc. ..... *
Powers Regulator Co. .....Insert 17-20
Pratt, Henry, Co. ..... *

ALPHABETICAL INDEX OF ADVERTISERS

Q

Quickdraft Corp. 126

R

Radiant-Ray Radiation, Inc. 135
Reading Tube Corp. ..... *
Research Products Corp. 45
Revere Copper & Brass, Inc. ..... *
Reznor Manufacturing Co. ..... *
Ric-Wil, Inc. ..... *

S

Sarco Co., Inc. 111
Sarcotherm Controls, Inc. ..... *
Skidmore Corp. 119
Smith, Jay, R., Mfg. Co. 137
Southwest Heating & Air Conditioning Exposition 140
Spence Engineering Co., Inc. 42
Sporlan Valve Co. ..... *
Spraying Systems Co. ..... *
Sterling, Inc. 128
Stoddard Industries 141
Sturtevant Div., Westinghouse Electric Corp. 49
Symmons Engineering Co. ..... *

T

Taco Heaters, Inc. 37
Todd Shipyards Corp. ..... *
Tuttle & Bailey Div., Allied Thermal Corp. ..... *

U

United States Steel Corp., National Tube Div. ..... *

V

Ventil-Aire Corp. 135
Vibration Mountings, Inc. ..... *
Vilter Manufacturing Co. ..... *

W

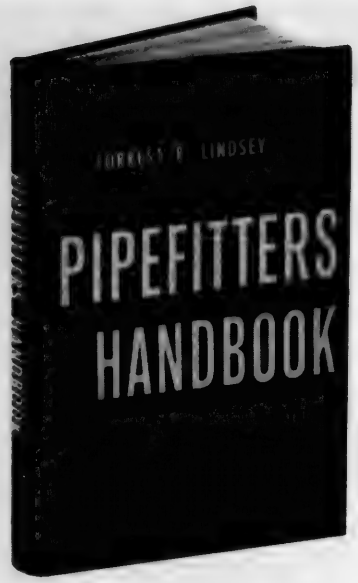
Wagner Electric Corp. 28
Waterloo Register Co., Inc. 38
Watsco, Inc. 135
Watts Regulator Co. ..... *
Webster Electric Co. ..... *
Webster, Warren & Co., Inc. 9
Weil-McLain Co. 34
Weil Pump Co. ..... *
Weirton Steel Co., Div., National Steel Corp. ..... *
Weksler Instruments Corp. 134
Western Engrg. & Mfg. Co. ..... *
Westinghouse Electric Corp., Sturtevant Div. 49
Wheeling Steel Corp. ..... *
Wiremold Co. 136

Y

Yarnall-Waring Co. 138

*Advertiser appeared in preceding issue

fresher
purer air
Air dust-free as wind-scoured mountain slopes! Dust-magnet filters are electrostatic, trapping particles small as 1/10th of a micron. Permanent, non-clogging . . . when dirt-laden simply rinse clean and replace in unit. Available for furnaces and air conditioners. As you live and breathe . . . install Dust-magnets!
DUST-magnet
FILTERS
a product of Stoddard Industries
3383 E. Layton Ave., Cudahy, Wisconsin



New, Enlarged Second Edition of Sell-out Shop and Field Manual

Gives 44% More Ready-to-Use Information at NO Increase in Price!

Pipefitters, steamfitters, layout men, contractors, plumbers—anyone concerned with the layout and installation of pipe—can find ready answers to all pipefitting problems in the PIPEFITTERS HANDBOOK. To save time in bending, fitting, welding, offsetting, joining or laying out pipe, just open PIPEFITTERS HANDBOOK to the appropriate, easy-to-find table, and do the job quickly without complex calculations.

This book is based on the actual working notebook of a successful pipefitter with 35 years' experience. Forrest R. Lindsey knows his craft and knows what YOU need to save time in the field or in the shop. Every working table has an easy example of how to use it and is backed up by data you can apply in your work: Laying lengths and dimensions of all standard pipe (including plastic) and fittings, screwed, welded, soldered or flanged; pipe support spacing; how to make joints at any angle; construction of brackets; areas and volumes of many different shapes; and much more shown in the table of contents at the left.

The second edition provides 126 more pages of useful information on many more subjects than the first. It extends the range of time-saving tables for bending and offsetting pipe and covers additional kinds of pipe and fittings. A complete, new treatment of plastic pipe, and a comprehensive subject index are included.

Ideal for use in the shop or in the field, PIPEFITTERS HANDBOOK is designed for long life and service. Handy to use, in a convenient pocket-size, it is printed in large black, non-smudge type on durable paper. You'll want it with you on every job . . . in the shop or in the field. Send for it today!

416 pages
248 illustrations

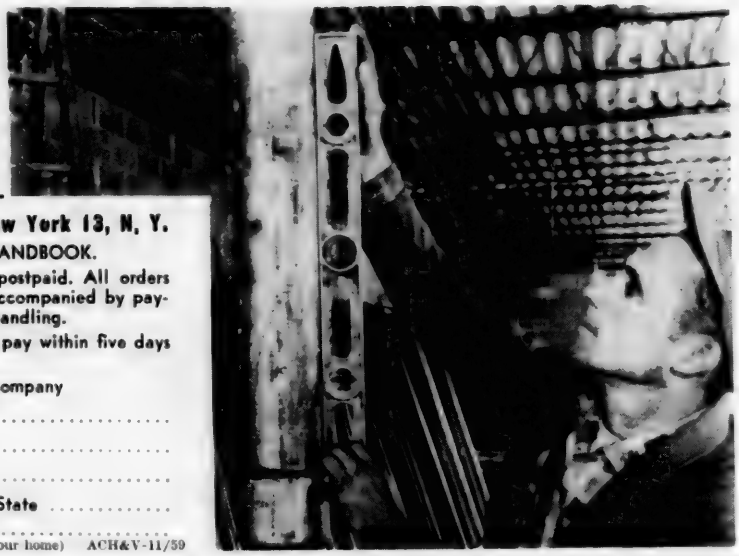
$6.00

Indexed
4¼" x 6⅝"

To order use handy coupon below or circle letter P on postpaid card last page.

CONTENTS

PIPE BENDING: *Setback and Length of Bend—Offset and Crossover Bends—Expansion U-Bends—90° Turns—Coils—Minimum Bending Radius—Wrinkle Bends.* SCREWED OFFSETS: *Common Offset Connections—Travel and Run—Rolling Offset—Screwed Turns—Screwed Coils.* MITERED JOINTS: *Welded Turns—Mitered Coils—Mitered Brackets—Templates for Mitering.* PIPE DIMENSIONS: *Iron and Steel Pipe—Copper Tube.* SCREWED FITTINGS: *Threading Pipe—Standard Threads—Fitting Dimensions—Clearance for Turning—Laying Lengths.* BUTT WELDING FITTINGS: *Elbow, Tees and Crosses—Valves.* FLANGES AND FLANGE FITTINGS: *Drilling Flanges—Fitting Dimensions—Valve Dimensions—Flanges and Gaskets.* SOLDER JOINT FITTINGS: *Soldering and Brazing.* U-BOLTS. SPACING OF HANGERS. WATER IN PIPES. PIPE EXPANSION. CONTENTS OF TANKS. IDENTIFICATION OF PIPING SYSTEMS. VALVES. PLASTIC PIPE: *Dimensions and Pressure Limits—Characteristics.* METALS: *Spark Tests—Sheet Metal Weights—Weights and Melting Points.* STEAM. MATHAMATICAL DATA: *Circumferences and Areas of Circles—Squares and Square Roots—Areas and Volumes—Reciprocals of Numbers.* WEIGHTS AND MEASURES. CONVERSION TABLES: *Inches to Decimals of a Foot—Fahrenheit-Centigrade—Feet of Water to psi—Psi to Feet of Water—Cubic Feet to Gallons—Gallons to Cubic Feet—Miscellaneous Conversion Factors—Useful Formulas.* TRIGONOMETRY: *Trigonometric Functions—Right Triangle Formulas—Solving Problems.* FIELD LAYOUT OF ANGLES: *Angles on the Steel Square—Angles on the Six-foot Rule.* PIPEFITTERS DICTIONARY.



THE INDUSTRIAL PRESS, 93 Worth Street, New York 13, N. Y.

Please send me ..... copies of PIPEFITTERS HANDBOOK.

☐ Check or money order is inclosed. Send book(s) postpaid. All orders from foreign countries—except Canada—must be accompanied by payment in full including 50c per book postage and handling.

☐ Send book(s) and invoice including postage. I will pay within five days if I decide to keep the book(s).

☐ Bill me ☐ Bill company

Name .....

Company .....

Company Address .....

City ..... Zone ..... State .....

Home Address .....

(Fill in last line only if you want book sent to your home) ACH&V-11/59

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

QUALITY MOTOR CONTROL ..... by Allen-Bradley is a natural for new buildings. Its simple one-moving part solenoid design assures millions of trouble-free operations. Double break, silver alloy contacts never needs service attention. Bulletins available.
Inside Front Cover — Item 200

STEAM HUMIDIFIERS ..... designed by Armstrong make excellent additions to air conditioning systems. Since they utilize dry steam, they do not create moisture and corrosion problems common with some methods. No lag in response to humidity control. Bulletins available.
Page 1 — Item 201

ZONING VALVE ..... offered by Heat-Timer has 100% shut off for positive temperature control on steam, hot and chilled water systems. New brochure containing layouts, applications, customer benefits, technical data, and prices is available.
Page 2 — Item 202

GAS AIR CONDITIONING ..... will be installed in Akron's luxurious Carlton House, marking the largest individual use of gas air conditioning units in a single apartment house. Summer cooling and winter heating will be provided for the suites by fifty-eight 3½ and 5-ton Arkla-Servel Sun Valley units. Information available.
Pages 4-5 — Item 203

FLUSH VALVES ..... supplied by Coyne & Delany have been specified for the Travelers office building now nearing completion in Boston. For years to come these diaphragm-type flush valves will provide the building with built-in insurance against flush valve maintenance headaches. No initial cost premium. Information available.
Page 7 — Item 204

HEATING AND COOLING ..... for whatever application, can be accomplished with one of Webster's products. The Warren Webster man will study your specific problem and recommend the products that most efficiently meet your comfort requirements. Information available.
Page 9 — Item 205

AIR CONDITIONING EQUIPMENT .... from The Governair Corp. is called "Satisfabricated." Equipment can be manufactured to fit almost any space and load requirement. Detailed information is available.
Page 11 — Item 206

SPECIAL CEMENT LINING ..... for Patterson-Kelley storage water heaters, called Pre-Krete, adds years of rust-free service. The rust and corrosion resistant hydraulic cement lining is extraordinary in composition and uniformity. Does not chip, crack or flake up to 900 deg F. Lined heater costs slightly more, lasts twice as long. Information available.
Pages 12-13 — Item 207

LIGHTWEIGHT COPPER TUBE is easy to install. Overhead work is easier with Anaconda copper tube. Use it for your next drainage installation. Information is available.
Page 15 — Item 208

NEW INSTRUMENT SERIES ..... by Powers offers precise control, easy-to-read scales, simple and easy adjustment, minimum service and maintenance, reliability and attractive modern design. Includes temperature, submaster, and pressure regulators; transmitters and receiver-controllers for heating, air conditioning, and industrial processes. Information available.
Insert 17-20 — Item 209

LUXURY APARTMENTS HEATED ..... with Burnham compact-type steel boilers. Intallation in Stewart House apartments provides maximum heat capacity in minimum floor space. Company offers complete line of Scotch-type and Scotch-type packaged boilers, in certified ratings up to 4,000 sq ft. Full ratings and data available.
Page 21 — Item 210

FIBER GLASS DUCT LINER ..... offered by Johns-Manville keeps air ducts quiet and makes them more efficient. Of light weight material, resilient and strong, rolls are easy to cut and fit, as well as pleasant to handle. Provides maximum insulation value for dollar invested. Specification and installation data available.
Pages 22-23 — Item 211

HEATING SPECIALTIES ..... by Marsh include uniformly good radiator valves, traps, and vents. Valve is truly packless, its annular mechanical seal keeping it drip tight throughout its long life. Diaphragm is extremely rugged, but very sensitive. Catalog offered.
Page 24 — Item 212

LEAK-PROOF UNIT HEATERS ..... are a "best buy" for spot-heating in plants and commercial buildings. Flexible, economical, and dependable, they are found in thousands of installations. Leakage inside Buffalo Forge unit is eliminated. Bulletin available.
Page 25 — Item 213

COPPER WATER TUBE ..... bearing the Bridgeport label is being used in many hospitals from coast to coast because it is so long lasting and dependable. Hospitals use it for plumbing, heating, refrigeration, and for oxygen systems. Easier and faster handling results in lower installation cost. Information available.
Pages 26-27 — Item 214

POLYPHASE MOTORS ..... drive central-station compressors for St. Louis County Hospital intern housing. Power-packed Wagner units start compressor loads smoothly and easily, are small in size, light in weight, hence easier to install and maintain. Engineering analysis of your applications offered.
Page 28 — Item 215

COOLING TOWERS ..... from Halstead & Mitchell boast a 20-year guarantee. Specially treated wood decking resists rotting, fungus attack, and algae which accumulates and obstructs air flow in most other towers. Information is available.
Page 31 — Item 216

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

CONSTANT THERMOSTATIC CONTROL is provided with Lawler's Type S temperature regulators. These are used wherever highly accurate control is vital. Unit features sensitive liquid filled element for instant activation, stainless steel sliding parts for long-lived friction-resistant operation. Information available.
Page 32 Item 217

CORROSION-RESISTANT PUMPS ..... are made with many materials of construction by Buffalo so that they are capable of handling the toughest liquid moving job. You can order a pump in almost any material that can be cast or machined. Information available.
Page 33 Item 218

MODERN BOILERS FOR SCHOOLS .... are available from Weil-McLain. Boilers supply forced hot water system circulating through underground piping for Wallingford, Conn., modern school. Cast iron sectional units are designed specifically to develop the economies possible with horizontal, rotary oil burners using low-cost heavy oil. Bulletin available.
Page 34 Item 219

TAILOR-MADE REFRIGERATION ..... for cold storage, ice making, air conditioning, quick freezing, very low temperature, or process cooling is available from Frick. By having the refrigeration system designed to meet your specific requirements and by buying the entire system of equipment from a manufacturer with experience and reputation in this highly specialized field you cut costs. Information available.
Page 35 Item 220

NEW CIRCULATOR ..... by Taco, called the Perfecta, eliminates circulator maintenance and service problems. Reason is its simple, sealed-unit design, with no seals, drive couplings, or starting switches to cause service problems. This water-lubricated pump is the most maintenance free, service free circulator ever built. Illustrated literature available.
Page 37 Item 221

AIR DIFFUSION EQUIPMENT ..... from Waterloo Register Co., Inc., is described in new, fully illustrated, color keyed 58-page catalog which contains complete data on wide range line of grilles and registers.
Page 38 Item 222

QUALITY DRAFT SERVICE ..... is guaranteed when you specify Clarage equipment. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Company is a specialist in building forced and induced draft fans for long-lasting service. Information available.
Page 39 Item 223

HIGH QUALITY VALVES ..... made by Jenkins are used for critical services but, because they cost no more, are preferred by many engineers for general use, too. Valves used in control of processes at Chrysler's huge new stamping plant, one of the top ten of the year, at Twinsburg, Ohio. Information available.
Page 40 Item 224

FAN CATALOG ..... describes the big blowers for big installations in The Massachusetts Line. Typical installation at 575 Lexington Ave., New York City uses 8 very large power-fixed fans producing a total of more than 410,000 cfm.
Page 41 Item 225

WHEN REGULATORS DEVELOP ..... trouble, engineers want to get them back on the line quickly. That's one reason why more engineers are standardizing on Spence regulating valves with externally mounted pilots. Bulletin is offered.
Page 42 Item 226

COMPLETE HEAT PUMP SYSTEM ..... by Chrysler is a money-saving answer to the problem of all-year air conditioning for hotels. System installed in Oregon takes advantage of low power rates and available well water. Each occupant has complete control. Information available.
Page 43 Item 227

FISHMOUTH BRANCH FITTINGS ..... offered by H. K. Porter cost, for example, only 81c for 2-inch size for run pipe to 36 inches. Makes the difference between breaking even and making a profit on competitive contracts. A 16-page booklet tells the whole story, shows costs for Fishmouth versus other branch connections.
Page 44 Item 228

EASY ODOR REMOVAL ..... with Research Products multi-velocity industrial filters: just apply RP Super Filter Coat to RP aluminum filters. Automatically removes dust and odors with no other equipment required. Information available.
Page 45 Item 229

DRAFTLESS AIR DIFFUSERS ..... from Anemostat supply conditioned air at the Sterling & Francine Clark Art Institute in Williamstown, Mass. Selection manual for air diffusion equipment is offered.
Page 46 Item 230

4-WAY REVERSING VALVES ..... for all reverse cycle systems are made by Alco of cast iron and steel, like a compressor, for long, reliable life. No plastics are used. Independent laboratory tests of 300,000 cycles were without failure to shift and without loss of tight seating. Specifications available.
Page 47 Item 231

LATEST ARI DIRECTORY ..... of Certified Unitary Air-Conditioners is offered free by Air Conditioning and Refrigeration Institute. It lists all participating manufacturers, their models, and certified ratings for each model.
Page 48 Item 232

CERTIFIED CENTRIFUGAL FANS ..... available from Westinghouse are the only airfoil centrifugal fans with Air Moving and Conditioning Association (AMCA) certified ratings. A catalog on these Series 8000 is available.
Page 49 Item 233

STEAM-SAVING CONTROL .. .. by Johnson cuts costs by using exhaust steam. Control hook-up switches to live steam only when necessary. Savings are automatic. Heart of hook-up is three-way by-pass valve which does the work of two ordinary valves. Information available.
Page 50 Item 234

NEW DUCT LINER ..... called Ultralite has special fire-resistant coating to conform to strictest fire codes. Fire-resistant coating is offered at no extra cost with this well-known glass fiber duct liner made by Gustin-Bacon. Specification data and samples are available.
Page 51 Item 235

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement. All advertisements are digested here except those that are received too late for inclusion in this listing.

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

NEW ALL-IN-ONE-BURNER .....
by Petro bolts to boiler front. The average installation saving in firebox boilers is $250, because boiler base and fire brick combustion chamber are eliminated. New burner head cuts fuel, costs, too. Complete information available.
Page 107 Item 236

CENTRAL STATION MANUAL .....
published by Drayer-Hanson contains 48 pages describing the company's popular 30-model central station air conditioning units (horizontal and vertical) as well as handy time-saving fan performance curves.
Page 108 Item 237

PORTABLE PYROMETER .....
manufactured by Illinois Testing Labs in a wide selection of thermocouples and extension arms assures adaptation to your needs. Eight scaled ranges are available up to 2000 deg F. Bulletin is available.
Page 109 Item 238

FULL LINE OF HEATERS .....
offered by Dravo includes a size and type for every heating need—backed by a highly trained and extensive service organization, with a reputation for dependability and thoroughness. Information is available.
Page 113 Item 239

STEAM HEATING SPECIALTIES .....
by Dunham-Bush cover the full range from 25 inches of vacuum to 150 lb pressure. Free brochure details the heating line and explains the advantages of dealing with "one source—one responsibility."
Page 115 Item 240

AIR CONDITIONING COMPRESSOR ...
manufactured by Bell & Gossett guarantees quiet air conditioning. It runs smoother, quieter and with a minimum of vibration. Precision manufactured. Seldom needs servicing, but when it does, usually all the parts needed can be carried in two hands. Complete specs and application data available.
Page 117 Item 241

NEW HEATING PUMP .....
has vertical close-coupled pump and motor unit bolted to receiver. Receiver is cast iron for long wear. Low returns. Quiet operation. Comes completely assembled. Bulletin available from Skidmore.
Page 119 Item 242

HIGH VELOCITY AIR FILTERS .....
from Air Filter Corp. feature high efficiency, minimum resistance, no direct air passage and large dust holding capacity. Catalogs are available.
Page 120 Item 243

AIR FILTER INSTITUTE .....
lists its membership in ad. You can buy air filters with confidence from these members. Information available.
Page 121 Item 244

PREFABRICATED VANE RAIL .....
by Cain eliminates layout, tab cutting, hole punching, etc. Savings up to 70% over old methods. Said to be best method ever devised for installing turning vanes in square elbows. Information available.
Page 121 Item 245

REGISTER AND GRILLE CATALOG ....
details the entire line of Agitair units. A wide range of sizes and styles meets every requirement of the architect and designer. Available in aluminum, stainless, bronze, brass, standard steel and plated finishes.
Page 121 Item 246

HOT WATER HEATER .....
of the automatic, commercial type is offered by Ewing Mfg. Co. It is called the low cost answer to the hot water problem for laundries, restaurants, motels, schools and apartments. Prices and details available.
Page 122 Item 247

UNIVERSAL CIRCULATORS .....
offered by B & G perform dual functions at Church of the Brethren, Elgin, Ill., religious paper publisher. They handle chilled water for 300-ton cooling system. Also used as condenser water pumps. Extra quiet operation. Long-sleeve bearings. Mechanical seal prevents leakage. Information available.
Page 123 Item 248

TOMORROW'S HEATING .....
is provided for by the installation, today, of the Cyclotherm steam and hot water generator. Unit is built under one roof and shipped fire-tested and ready to operate. Up to one-third smaller than any other package of the same capacity. Information available.
Page 124 Item 249

YEAR-ROUND COMFORT .....
is provided by the extremely popular large capacity McQuay Seasonmakers. Heats, filters air in cold months, and cools, dehumidifies, and filters air in warm months. Available in 2-3-5 ton capacities with 3-speed operation. Catalog available.
Page 125 Item 250

POWER DRAFT UNIT .....
for industrial, residential and institutional exhausting, is available from Quickdraft. It increases heating and combustion efficiency with no motors, fans or bearings in exhaust lines. Engineering data are offered.
Page 126 Item 251

ALUMINUM DOOR LOUVERS .....
offered by Construction Specialties are precision engineered into neat, attractive and practical units. Though competitive with sheet metal assembles they have many attractive qualities available only in extrusions. New catalog available.
Page 127 Item 252

SPRING CLOSES STEAM TRAP .....
when thermostat is damaged, says manufacturer, Sterling, Inc. Trouble is located immediately because radiation becomes cold. There is no waste of steam. Information is available.
Page 128 Item 253

RUGGEDLY-BUILT COILS .....
in the Bohn line are chosen because they are tested and rated according to ASRE-ASHAE Standard 33-58. Coils have die-formed plate-type aluminum fins, from 4 to 14 per inch, with self-spacing collars completely covering the tubes. Information available.
Page 129 Item 254

NEW MOTOR OPERATOR .....
is a transistorized electronic device for proportional control applications—individual room control, fan coil units, reheat coils, etc. No tubes or relays, but electronic control at no extra cost. Bulletin from Barber-Colman available.
Page 130 Item 255

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

AIRTURNS .....
available from Barber-Colman, guide air around corners in duct systems, saving space and money. They minimize pressure losses, too. Superior to the performance of any other factory-made units available. Mass production results in modest initial cost. Complete details available.
Page 131 Item 256

ECONOMICAL WATER HEATER .....
made by Bryan Steam is oil or gas fired to meet your requirements, no matter how small or how large. Indirect heat exchanger method provides low cost hot water, economies, and compactness. Catalog available.
Page 132 Item 257

BOILER WATER LEVEL CONTROLS ...
by Magnetrol offer low-maintenance boiler safety. All you have to do to keep them in safe shape is to blow-down the float chamber once a shift, inspect the switches once a month. Catalog available.
Page 133 Item 258

GAS-FIRED AIR MAKE-UP .....
with units manufactured by Aerovent increases production capacity and improves fan and heating efficiency. Units supply ample quantities of clean, preheated or cooled outside air to replace air exhausted by ventilating systems. Bulletin offered.
Page 133 Item 259

FLEXIBLE HOSE .....
from The Flexaust Co. is adaptable for all kinds of fume and dust control and ventilation uses. It is durable, lightweight, and easy to install. Details are available.
Page 134 Item 260

NEW SPECIFICATION BULLETIN .....
tells how to specify pressure gages, industrial thermometers, dial thermometers, recording thermometers, recording hygrometers, and bi-metal dial thermometers, manufactured by Weksler.
Page 134 Item 261

ROOF-MOUNTED SYSTEM .....
for air conditioning and heating of single story commercial and industrial buildings offered by Ventil-Aire. Based on 10,000 sq ft building, 28% is saved on installation and 11% in construction costs. Company offers illustrated literature and case histories to prove its point.
Page 135 Item 262

FINNED TUBE RADIATION .....
from Radiant-Ray "custom fits" without cutting, slashes installation time and expense. Catalog is offered.
Page 135 Item 263

CAPILLARY CONTROL VALVE .....
specifically designed for use in reverse cycle systems is introduced by Watsco, Inc. Valve is applicable to all units up to 5 tons. Catalog is offered.
Page 135 Item 264

COMBINATION BURNERS .....
are available for this company's industrial heaters and are interchangeable with single fuel burners. Lennox "task matched" equipment controls and conditions air for industry. Engineering data are offered.
Page 136 Item 265

AIR DUCT .....
by WiremolD is joined simply by screwing together. No collars or clamps. Joint is as firm and strong as the duct itself. For air conditioning, exhausting, materials handling, and many other applications. Information available.
Page 136 Item 266

DUCT-SEALING TAPE .....
from Arno Adhesive Tapes, Inc., provides the fastest, easiest way to seal ducts and apply insulation. Free sample, information are offered.
Page 137 Item 267

EXTRUDED ALUMINUM SHUTTERS ....
from Elgo Shutter & Mfg. Co. are of modern design, light weight, fully weather-stripped, easier to install, and are rust and corrosion proof. Complete specifications are available.
Page 137 Item 268

STOP WATER HAMMER .....
and control hydrostatic shock with Jay R. Smith's hydrostatic shock control. Designed to last the life of the piping system without failure, unit is available in six sizes. Booklet is available.
Page 137 Item 269

ADJUSTABLE SPROCKET RIM .....
with chain guide, offered by Babbitt, changes a danger zone into a safety zone when overhead valves are so equipped. Pipe layout simplified. Units fit any size wheel, are easy to install, save time and money. Information available.
Page 138 Item 270

EXPANSION JOINTS .....
from Yarnall-Waring Co. may be serviced in the line under full steam pressure. Costly shutdowns are eliminated. Fewer expansion joints needed. Low maintenance. New catalog available.
Page 138 Item 271

PACKAGED BOILERS .....
by International cost less to own because low day-to-day operation, cleaning, and maintenance costs, plus unsurpassed fuel economy of these water tube units cannot be equaled. Full details in bulletins offered.
Page 139 Item 272

SOUTHWEST H&AC SHOW .....
in Dallas, Texas, February 1 to 4, 1960, will keep you up with recent developments. Complete information on the 2nd Southwest Heating and Air-Conditioning Exposition, under the auspices of ASHRAE, available.
Page 140 Item 273

PERMANENT FILTERS .....
for furnaces and air conditioners are offered by Stoddard Industries under the Dust-magnet label. Non-Clogging, when dirt laden they are simply rinsed clean and replaced in unit. Traps dust to 1/10 micron. Information available.
Page 141 Item 274

VALVE LINE .....
bearing the name Henry carries with it complete assurance of on-the-job satisfaction. Includes packless, packed, and wing cap type shut-offs; piston and diaphragm type pressure relief valves; spring loaded and free floating type flow checks; sealed and cartridge type filter driers; strainers. Information available.
Inside Back Cover Item 275

NEW 2-INCH VALVE .....
rounds out a series of safety relief valves in the McDonnell line for hot water space heating boilers that fulfills a vital need. A new bulletin shows why and how the entire rated capacity of the company's relief valves is obtained without diaphragms or other auxiliary lifting devices. Valve operation explained. Bulletin lists a valve for practically every boiler.
Back Cover Item 276

CIRCLE FOR NEW EQUIPMENT AND LITERATURE INQUIRIES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110

CIRCLE FOR AD-DIGEST INQUIRIES

200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309

PLEASE PRINT CLEARLY

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....Zone ....State .....

TO ORDER BOOKS DESCRIBED BELOW

Please send and bill me for the books circled: November '59

A B C D E F G H I J K L M N O P Q R S T U V

This service is not available to overseas readers. Cards are void after February 1, 1960.

FIRST CLASS
PERMIT NO. 83
NEW YORK, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE NECESSARY IF MAILED IN UNITED STATES

POSTAGE WILL BE PAID BY

AIR CONDITIONING, HEATING and VENTILATING
93 WORTH STREET
NEW YORK 13, N. Y.

READERS SERVICE DEPT.

BOOKS TO HELP YOU WITH YOUR DESIGN PROBLEMS

DESIGN OF AIR CONDITIONING SYSTEMS
by F. W. Hutchinson

115 full-page charts solve problems of air conditioning system design involving cooling load, duct design, psychrometrics, solar energy, comfort conditioning, panel cooling, etc. For each chart the engineering and mathematical background plus design example and solution are given. **336 Pages, 118 Illus., $7.00.**

TO ORDER CIRCLE **B** ON CARD ABOVE

DESIGN OF HEATING AND VENTILATING SYSTEMS by F. W. Hutchinson

96 full-page charts solve problems of heating and ventilating involving load determination, duct design, panel heating, solar heating and combustion analysis. Companion book to Design of Air Conditioning Systems. Same methods to explain and solve problems are used. **320 Pages, 96 Charts, $7.00.**

TO ORDER CIRCLE **C** ON CARD ABOVE

COMBINATION OFFER

Both of the above books by Prof. F. W. Hutchinson, $12.50.

TO ORDER CIRCLE **D** ON CARD ABOVE

IT'S EASY TO GET THE BOOKS YOU NEED

Just circle the appropriate letters on one of the cards above and drop it in the mail. We'll ship the books and bill you. Or you can save book postage if you send payment with your order. Either way, you have full return privileges if not satisfied.

HANDBOOK OF AIR CONDITIONING, HEATING AND VENTILATING
Edited by Clifford Strock

Completely new book containing thousands of facts, figures, data and principles; hundreds of charts, tables and maps. Answers problems you face every day in your work. Subjects treated thoroughly include: Air Conditioning, Air Handling, Building Heat Loss, Climatic Data, Combustion, Degree-Days, Dual Duct Design, Dust Collection, Fuel Estimating, High Velocity Air, Mathematics, Motors, Piping and Plumbing, Psychrometry, Radiator Heating, Refrigerants, Service Hot Water, Solar Data, Steam Flow, Ventilation, Warm Air Heating, Terminology and a complete cross index. **1094 Pages, 7¾" x 10¾", 598 Charts, Maps, Illus., 518 Tables, $15.00.**

TO ORDER CIRCLE **L** ON CARD ABOVE

SUMMER AIR CONDITIONING
by S. Konzo, J. R. Carroll and H. D. Bareither

Training text and reference book on residential air conditioning for all who design, sell, install or operate these systems. Diagrams show mechanisms and principles of operation. Information understandable to beginner. Tells *how* and *why* things are done the way they are and *what* makes equipment operate the way it does. **560 Pages, 266 Illus., $8.00.**

TO ORDER CIRCLE **T** ON CARD ABOVE

WINTER AIR CONDITIONING
by S. Konzo, J. R. Carroll and H. D. Bareither

Does for heating what *Summer Air Conditioning* does for cooling. **640 Pages, 317 Illus., $8.00.**

TO ORDER CIRCLE **U** ON CARD ABOVE

COMBINATION OFFER

Both of the above Air Conditioning books, $15.00.

TO ORDER CIRCLE **V** ON CARD ABOVE

MORE BOOKS LISTED ON OTHER SIDE→

FIRST CLASS
PERMIT NO. 53
NEW YORK, N. Y.

This service is not available to overseas readers. Cards are void after February 1, 1960.

BUSINESS REPLY MAIL
NO POSTAGE NECESSARY IF MAILED IN UNITED STATES

POSTAGE WILL BE PAID BY

AIR CONDITIONING, HEATING and VENTILATING
93 WORTH STREET
NEW YORK 13, N. Y.

READERS SERVICE DEPT.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221
222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265
266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309

CIRCLE FOR NEW EQUIPMENT AND LITERATURE INQUIRIES

CIRCLE FOR AD-DIGEST INQUIRIES

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....**Zone** ....**State** .....

PLEASE PRINT CLEARLY

Please send and bill me for the books circled: November '59

A B C D E F G H I J K L M N O P Q R S T U V

TO ORDER BOOKS DESCRIBED BELOW

USE CONVENIENT CARD ABOVE TO ORDER THESE BOOKS

HIGH TEMPERATURE WATER SYSTEMS
by Owen S. Lieberg

A complete and concise exposition of the principles, design, installation and application of high temperature water. Written by the designer of many of the world's largest systems. For engineers, operators, and owners. **224 Pages, 109 Illus., $6.50**

TO ORDER CIRCLE M ON CARD ABOVE

METHODS OF JOINING PIPE by J. E. York

The most detailed information available on standards and special joints for all types of metallic, glass, tile, plastic and concrete pipe. Data on joints designed to take up movement due to expansion and contraction. **236 Pages, 249 Illus., $4.00.**

TO ORDER CIRCLE O ON CARD ABOVE

DESIGN OF INDUSTRIAL EXHAUST SYSTEMS
Completely revised 3rd Edition
by John L. Alden

This classic text on how to design, build and buy industrial exhaust systems has been brought up-to-date to meet modern standards of industrial environment. Developments and advances in devices and techniques described. **256 Pages, 137 Illus., $6.00.**

TO ORDER CIRCLE E ON CARD ABOVE

DESIGN OF PLUMBING AND DRAINAGE SYSTEMS by L. Blondermann

Detailed, illustrated guide covering modern plumbing practice and design. Basic problems as well as modern specialized topics are discussed. **328 Pages, 201 Illus., $7.00.**

TO ORDER CIRCLE F ON CARD ABOVE

FLUID FLOW IN PIPES by C. H. McClain

How to solve problems involving the flow of liquids and gases through pipes. How to handle viscosity, friction, heat, and other factors expressed in various dimensional systems. Worked-out problems show applications of principles. **124 Pages, 18 Illus., $4.00.**

TO ORDER CIRCLE J ON CARD ABOVE

PLANT AND PROCESS VENTILATION
by W. C. L. Hemeon

Design factors and data that can be applied to any situation. Principles are clear, logical. Shows how to estimate exhaust requirements for dust and fume producing processes, hot or cold. Principles of general ventilation and bulk materials handling. **448 Pages, 172 Illus., $9.00.**

TO ORDER CIRCLE Q ON CARD ABOVE

INDUSTRIAL HEAT TRANSFER
by F. W. Hutchinson

Provides 123 time-saving working graphs for the direct solution of most commonly encountered problems. Graphs are equal in accuracy to the equations from which they are derived and help eliminate errors in calculation. **336 Pages, 136 Charts and Illus., $7.00.**

TO ORDER CIRCLE N ON CARD ABOVE

SNOW MELTING by T. Napier Adlam

Correct, tested steps in planning, designing, building and operating snow melting systems. Time saving charts, tables and graphs give data and simplify every step. **224 Pages, 189 Illus., $4.50.**

TO ORDER CIRCLE S ON CARD ABOVE

FLOW AND FAN by C. H. Berry

Covers the *flow* of gas through ducts, and *fan* performance and control; moving air through ducts, fan selection and control, duct arrangement, system characteristics, flow analysis. Basic data and methods used to calculate system resistance. Practical information for selecting a fan for any duty. **232 Pages, 84 Illus., $4.00.**

TO ORDER CIRCLE I ON CARD ABOVE

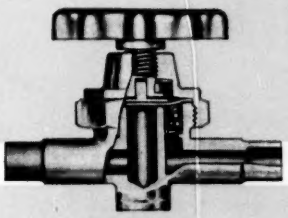
HENRY VALVE CO.

CONTROLLING FLOW SINCE 1914

Every product bearing the name Henry carries with it complete assurance of on-the-job satisfaction. This quality of performance and the confidence it inspires have made Henry the most accepted line in the industry.

VALVES—Shut-off

Packless, Packed and Wing Cap Types

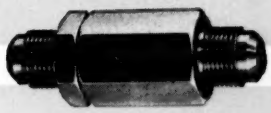


VALVES—Pressure Relief

Piston and Diaphragm Types

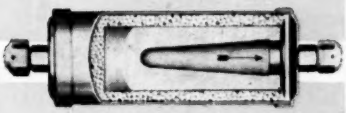
VALVES—Flow Check

Spring Loaded and Free Floating Types



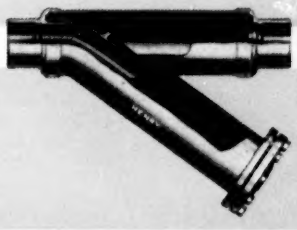
FILTER-DRIERS & Driers

Sealed and Cartridge Types



STRAINERS—All Types

Sealed and Cleanable



HENRY VALVE COMPANY

For Refrigeration, Air Conditioning and Industrial Applications

ELROSE PARK, ILLINOIS, U.S.A. CABLE: HEVALCO, MELROSE PARK, ILL.

The family has grown!

...in size...in importance

The addition of a new and finer McDonnell 2-inch valve rounds out a line of safety relief valves for hot water space heating boilers that fulfills a vital need supremely well.

To know how true this is go back over the modern history of relief valves. With the rapid increase in closed systems, casualty companies, the National Board, and others concerned with boiler and heater safety went to work . . . and the net result was today's commendable A.S.M.E. Boiler Code calling for certified Btu-rated relief valves.

Closely following this work, McDonnell & Miller developed the first of all Btu-rated relief valves. They were not only first into the field; they are still first. They not only conform to the letter of the code; they go beyond this: *introduce new standards of their own.*

For Hot Water Space Heating Boilers

McDonnell Valve No.	Boiler Size Btu./hr.	Opening Pressure	Inlet	Outlet
230-¾ IN.-30	303,000	30 lbs.	¾"	¾"
240-¾ IN.-30	513,000	30 lbs.	¾"	1"
230-1 IN.-30	743,400	30 lbs.	1"	1"
240-1 IN.-30	910,000	30 lbs.	1"	1¼"
230-1½ IN.-30	1,025,100	30 lbs.	1½"	1½"
240-1½ IN.-30	1,560,000	30 lbs.	1½"	2"
240M-3	2,313,000	30 lbs. 36 lbs.	2"	1" 2"
240M-4	2,710,000	30 lbs. 36 lbs.	2"	1¼" 2"
240-2 IN.-30*	3,130,000	30 lbs.	2"	2½"
240-2 IN.-36*	3,550,000	36 lbs.	2"	2½"

*Recommended installation: 36 lb. opening valve, with smaller auxiliary valve set at 30 lbs. for thermal expansion.

New Bulletin P-33 gives up-to-the-minute facts

- A new bulletin shows why and how the entire rated capacity of McDonnell Relief Valves is obtained without diaphragms or other auxiliary lifting devices.
- It shows how this operation—this operation so basic to safety—is ideally accomplished by using specially calibrated "low rate" springs, matched to disc area to give smooth precise lift and tight closure.
- It explains the widely adopted McDonnell principle of progressive settings that keeps discharge in step with function . . . small valve relieving normal expansion; large stand-by valve ready for the emergency.

These and many more significant facts are covered in the bulletin. Note the accompanying table listing a valve for practically every boiler—McDonnell quality straight across the board.

Coupon brings your copy

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Your Jobber Stocks Them

McDONNELL

Send me a copy of new Bulletin P-33 covering McDonnell Safety Relief Valves for hot water space heating boilers.

COMPANY NAME _____

STREET ADDRESS _____

CITY, ZONE & STATE _____

BY _____

Mail to: McDonnell & Miller Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.